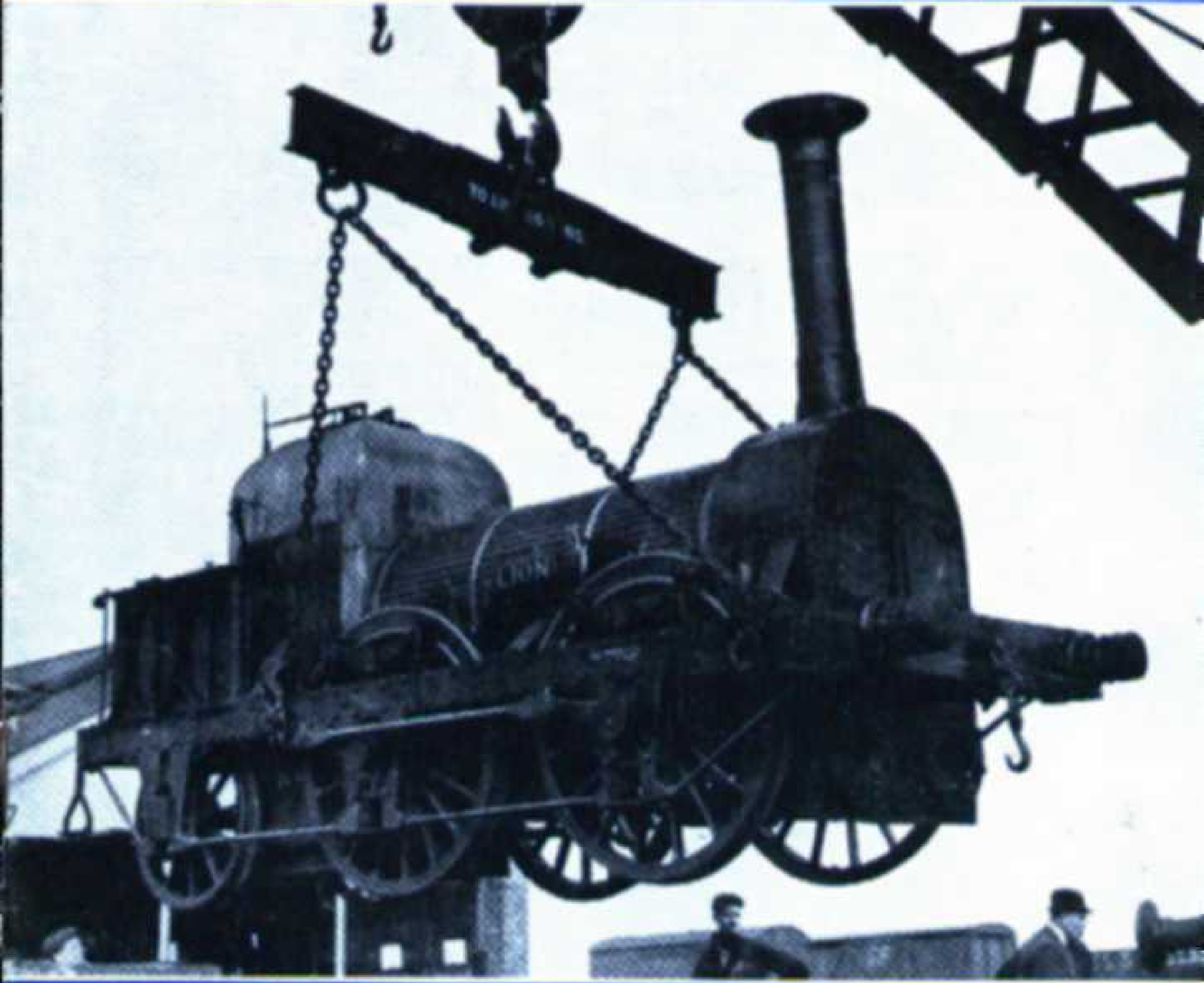
THE MODEL ENGINEER

12-21-53



IN THIS ISSUE.

- L.B.S.C.'s TITFIELD THUNDERBOLT
- READERS' LETTERS
- SPOTLIGHT ON NEW CAR DESIGNS
- QUERIES AND REPLIES
- MORE UTILITY STEAM ENGINES—THE "CYGNET" TWIN
- A BAND FINISHING MACHINE
- HUDDERSFIELD EXHIBITION

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THE MODEL ENGINEER

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CONTENTS

Our Cover Picture

The 116-year-old locomotive *Lion* has probably won wider renown than any other railway museum-piece, except the *Rocket*. The reason is that she has joined the ranks of famous film stars, for, renamed *Thunderbolt*, and now for ever associated with the delightful and fictitious old English town of Titfield, she has won, not only honour and glory, but the hearts of all who have seen her superb performance in that amusing film, "The Titfield Thunderbolt."

Her journey from Liverpool to the Ealing studios, London, was not of the kind usually undertaken by successful film stars, and, as our picture shows, necessitated changing at Watford by a process that may be best described, perhaps, as unorthodox ! That is to say, film stars and, in fact, most other travellers, do not usually change trains with the aid of an overhead crane.

SMOKE RINGS

Railway Exhibition: Peterborough

A RAILWAY exhibition, sponsored by British Railways, is being held in the Maxwell Art Gallery, Peterborough, until December 19th, 1953.

The exhibition, which includes models, photographs, historical railway documents and examples of poster art, was opened by Sir John Benstead, C.B.E., Deputy Chairman, British Transport Commission. Admission is free.

Colour Television

IN OUR issue of June 18th, we made a reference to the private colour television broadcast organised by Messrs. Pye Ltd., Cambridge for the benefit of children in the Great Ormond Street Hospital. This report has been severely criticised by one of our readers, who states that he is professionally connected with television, on the grounds that the transmission was carried out over a wired circuit, and therefore (in his words) "was no more television than speaking on the telephone is broadcasting." Before attempting to answer this criticism, we asked Messrs. Pye for further details of the experiment, in order to be sure of the facts. They have informed us that the programme was transmitted *over the air* by a low-power wide band ultra high frequency transmitter operating on 575 mc/s., and have also given us some very interesting details of the system and apparatus employed. We do not, however, propose to publish this in THE MODEL ENGINEER, as the subject is highly specialised, and hardly within the normal scope of this journal. But even had the transmission been over a wired circuit, as our correspondent suggests, we do not consider his criticism valid; the term "television," literally translated, means nothing more than vision at a distance, irrespective of the medium of transmission. No matter how it was accomplished, we feel sure that the majority of our readers will agree with us in congratulating Messrs. Pye Ltd., on a splendid achievement which will undoubtedly have a decided influence on the progress of British television.

2¼ Inches to the Foot

SEVERAL READERS have noted that the fine "galloping horses" roundabout by Mr. H. Slack, exhibited at the "M.E." Exhibition and elsewhere, is built to the scale of 2¼ in. to the foot, and we have been asked, more than once, why this should be so. Some of the questioners wanted to know if we had misprinted the dimension; others thought that it must have been "a very awkward scale to use, because 9/4 cannot be easily converted into twelve equal parts to give scale inches," or so they seem to think.

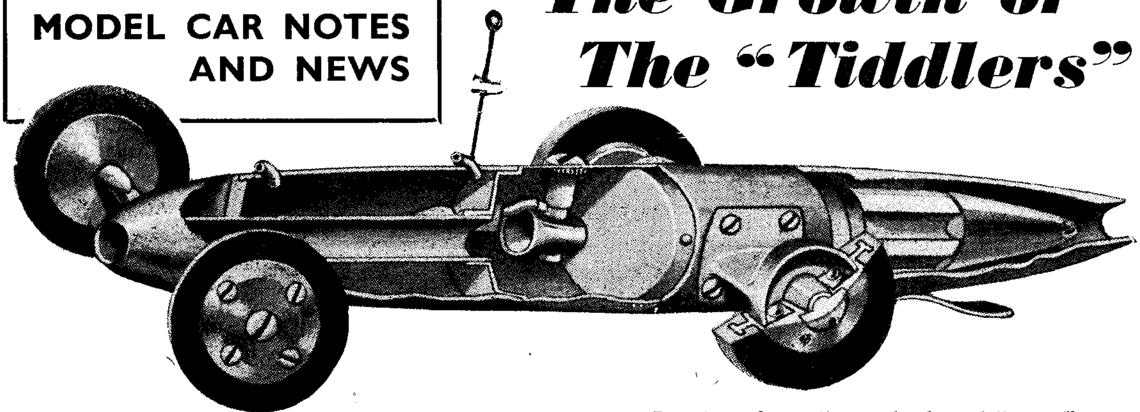
Such thoughts as these have now become really ancient "chestnuts," and we are surprised to note how hard they die! First, let us say we do not know exactly why Mr. Slack chose this particular scale; there was probably a very good reason, but we forgot to ask him, when he was at the "M.E." Exhibition.

Secondly, we can say that the figures were not misprinted, and thirdly, we cannot see that 2¼ in. is any more awkward than any other scale. Why should it be? Who wants to know what one-twelfth of nine quarters is as a fraction of an inch? There is certainly no need to find out, and nobody need bother his head about it.

It is strange that people can still be put right off their stroke, so to speak, when they encounter an unusual scale. There is really nothing unusual, awkward or terrifying in *any* scale of feet; it is merely a matter of thinking and working in scale feet and inches, whatever size they may be, as we have pointed out before. We once had an elaborate piece of work to do in the scale of 23/49 of an inch to the foot, but it gave us no trouble at all, simply because we did not look for trouble and were perfectly happy and content to think and work in feet and inches to that scale.

MODEL CAR NOTES AND NEWS

The Growth of The "Tiddlers"



Drawing shows "straight-through" air-flow to jet, and efficient exhaust extraction in the R.T.D. car. Note also the turned fuel-tank and engine units

By Geoffrey Deason

SIX years is no great length of time, you may think; yet it seemed a far cry to me when, one evening recently, I was browsing through an old volume of that much lamented little journal, *Model Car News*, and re-read "Why Not Class 'C' Racing," from the editorial pen of 1947. The editor was urging the encouragement of a smaller, less costly and less ambitious racing class than the existing 5 and 10 c.c. groups, and paused in his exhortations to bestow a benevolent pat on the back to your present scribe for his efforts to prove the baby racer a practical proposition.

An Ambition

I was, in fact, working with great enthusiasm to foster this idea, had built several small models with engines of about 1 c.c. which confounded the critics by running reliably, albeit at very modest speeds, and was scheming to organise a race meeting for models of this size alone. This ambition was achieved early in 1948, largely thanks to the generosity of Mr. Hector Cox, then sales chief of the M.G.Car Company, to whom I told my story whilst visiting the Abingdon works. Through his kindness I was able to offer for competition the historic little bronze statuette of the Magic Midget, made to commemorate Capt. G. E. T. Eyston's records in the "Baby" class, a most appropriate trophy for the new enterprise.

The first "all-Tiddlers" affair duly took place, despite gloomy forecasts of no entries, no speeds and no sense in it anyway, and turned out to be great fun. It was a modest little meeting, with thirteen entries, much enlivened by the presence of that great motoring personality, "Sammy" Davis, who was highly intrigued by the earnestness of all concerned, and in particular by the determination of one youngster, who, having cycled 70 miles overnight to compete, completed his six laps on hands and knees, pushing his car, scrubbing-brush fashion, in his efforts to start his recalcitrant motor ! The entries were all "commercial" diesels, housed in a delightfully diverse collection of cars. We built large and realistic in those days, every runner was at least recognisable as a motor car model, and the winner was a handsome free-lance two-seater powered by the then new 2.5 c.c. E.D., entered by Bernard Miles. His speed of 41.7 m.p.h. was a considerable shock to the 10 c.c. speed kings, up till then quite complacent with their 60's and 70's. It must be admitted that the majority of the entry fell some way below this, and I blushingly record that my own car, a semi-scale M.G. Magnette, finished last but one, at 27.14 m.p.h., after causing some hilarity by starting off backwards. "M.C.N." headed its report "Bravo, Class 'C' !" and although it was some time before official recognition was given to the 2.5 c.c. class, prejudice was broken down and the babies were there to stay. It is amusing to recall that we scribes were considerably exercised in our minds as to what prototypes the new class should be based on, with a strong bias towards the Half litre and 750 c.c. racing types. Dear me ! Could we but have looked five years ahead, I don't think we should have wasted our ink !

Prodigious Power

The class grew apace, in both numbers and performance. Home built engines were rarities at first, but the tuning wizards were soon extracting prodigious power from commercial units which had been designed originally for aircraft work, and in 1949, J. R. Parker took the honours at 55.02 m.p.h. with a neat little closed-cockpit model housing spur gearing and a very much "Parkerised" 2.5 c.c. E.D. Frontal area and drag had obviously been given much thought, and the Parker Special used the now universal knife-edged front tyres. Exceptions to the all-but-universal cult of the compression-ignition engine were seen in the shape of G. H. Pearce's tiny all-enclosed Special, which had magneto ignition, but no luck in competition, and J. Gascoigne's All-American contender, a Thimbledrome car modified to take one of the very successful Arden glow-plug motors, which finished second in the "M.G." at 47.2 m.p.h. (This might almost be said to be the only occasion on which the American menace reared its head in under 2.5 c.c. racing !)

Thus early it was possible to trace a definite pattern of development. Even at the modest speeds then obtaining, designers were beginning to consider, if not to profit from the reduction of frontal area and good aerodynamic form. For the 1949 contest, the 1948 champion, Bernard

Miles, produced a good-looking model with long graceful tail, open cockpit, and with three of its four wheels of knife-edge section, which recorded 48 m.p.h. and netted him second place, with an engine basically similar to that used by the winner. It is interesting to note that the victorious Parker Special used an identical front suspension arrangement to that employed by his 5 c.c. 1953 Championship winner (illustrated in our issue of October 1st last), and indeed was similar in most other respects as regards layout and dimensions !

1949 saw the swan-song of the ordinary "out-of-the-box" engine as a serious contender for major successes, although before the close of the year that master of tuning craft, F. G. Buck, turned his attention to a standard Elfin diesel engine of 1.8 c.c., to such good effect that in a car of his own construction it set the British 2.5 c.c. record to 62.5 m.p.h., during the first International meeting held against a visiting team from Sweden. The car itself, christened "Wee 2," was an exiguous affair, but it marked another milestone in the development of the baby racer, its most significant feature being its use of direct drive, by one wheel mounted on its single mainshaft. Although this most logical simplification had been seen before, notably on Jim Cruikshank's well-known 10 c.c. Mercury, it was new to the small class, and it set a fashion that thrives today. It entirely changed the style and proportions of the models, and posed thorny problems of its own. From being a large model with a small engine, the successful racing "Two-Five" shrank almost overnight to half its original size, its scale being entirely dictated by its wheel diameters. The reason for this is obvious, since every racing engine must operate at its optimum output, which is usually not far below its peak r.p.m., and having no gears to juggle with, wheel diameter becomes the only "variable." Although engines were still mainly of the long-stroke type, 9,000-10,000 r.p.m. was common, and to achieve this called for wheels of $2\frac{1}{2}$ in. or less. At this stage, too, that abomination, the push-stick, invaded the small class for keeps !

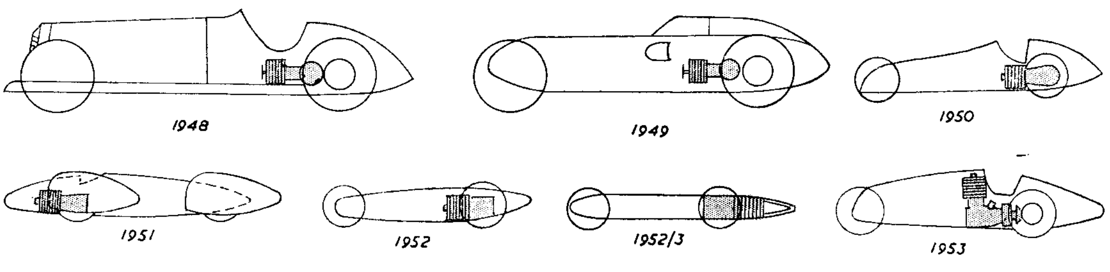


Diagram showing five years' progress in the under 2.5 c.c. class. Outlines show relative body and wheel sizes, and disposition of engines

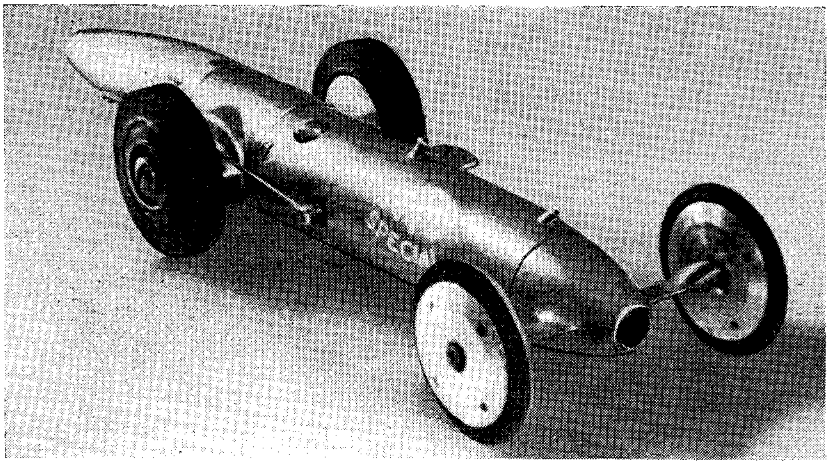
Covered with Glory

Before 1949 was out, the "Tiddler" class covered itself with glory, by its fine showing during the return visit of the British team to Sweden, the performance of the British babies being the highlight of the tour. Included in the British team was a name that was soon to loom large in the "Two-Five" and later, the "One-Five" class; that of John Oliver of Nottingham. The Olivers, father and son, had been building a sound and successful twin shaft diesel unit specifically for model car use, and marketing this in conjunction with a simple chassis. Spurred on by F. G. Buck's success, they set to work a few days before the Swedish trip to design an entirely new racing engine, again of twin shaft type, but having a reduced stroke/bore ratio and disc-type rotary inlet valve. This engine was built, bolted hastily into a tiny car of conventional outline and tested on the Derby Club's track just in time to be rushed up the gang-plank, and its success was immediate. This potent little motor was destined to become the dominant factor in small capacity racing, and its popularity remains unchanged today. The Oliver concern is very much a personal business, and its policy has always been based on close contact with its customers, whose experiences and experiments are frequently reflected in the production engine. The little "Tiger" unit was built entirely for model car work, and its design enabled the full benefit of nitrated fuels to be exploited. Of heavier and far more rigid construction than previous designs, and producing its power at considerably higher r.p.m., the engine employed 360 deg. exhaust porting, with rotary disc controlled inlet port, had a bore and stroke of 0.550×0.625 in., and had its mounting lugs arranged to allow simple horizontal installation. A neat and pleasing car of two-piece construction, having conventional racing car lines, was marketed to house the engine-drive unit.

From this time onwards, records fell almost monotonously to Oliver engines in cars of varying types, but far from discouraging private ventures, its success merely gave the individual experimenters something to shoot at, and there has never been any lack of competition from the home-built school. In their search for more speed, builders quickly abandoned the conventional racing car body for more wind-defeating forms. Alec Snelling of the Edmonton Club fitted a highly developed "Tiger" engine into a slim aluminium shell, the drive wheels being at the front, and both axles and wheels enclosed in narrow fairings of aerofoil section. With this car he took the British record in 1951, together with the M.C.A. class championship, recording 84.11 m.p.h. over the quarter mile on the Cleethorpes track. This represented an increase of over 12 m.p.h. on the previous year's class winner, F. G. Buck's "Wee 2."

Success

1952 results threw some doubt upon the value of total enclosure or streamlining of wheels and axles, for one ingenious enthusiast, Cyril Catchpole of the Surrey Club, discovered that two bottom-half castings of the standard Oliver car



" Beauty lieth in the eye of the beholder! " The R.T.D. is entirely functional, cost the builder 2/6d. for materials, and has a cross-sectional area of less than 1 square inch

could be mated together to form a body of low drag and light weight, and with this combination he had a highly successful season, finally winning the M.C.A. class championship at 85.3 m.p.h., and the recently established 1.5 c.c. class with a linered-down Oliver in a similar car at the astonishing speed of 70.47 m.p.h.

Geared Models

Meanwhile many new private ventures were under way, the " under two-five " classes having always provided the happiest and most fertile field of individual experiment in the model car racing movement. Ian Moore, hon. secretary of the M.C.A., who had achieved many successes in the larger categories, designed and built his " Shadow," which revived the conventional layout of the large bevel-geared " prototype " car of American style, but being of necessity more than ordinarily narrow; so narrow, in fact, that the finning on either side of the single shaft Oliver engine, together with the normal mounting lugs, had to be milled away to allow of its accommodation within the slim and beautifully constructed balsa envelope. This pleasing little job proved very fast from the outset, but preoccupation with the larger classes prevented its ultimate development by its original constructor, who disposed of it to F. S. Drayson. The return to geared drive and the conventional layout was fully justified when its new owner netted the 2.5 c.c. class in this year's M.C.A. Speed Championship !

Another well-known enthusiast to revert to gearing for his model for 1953 was Jim Dean, who ran a very advanced and unconventional car powered by an Oliver engine mounted with its cylinder facing rearwards, and having 1.6 : 1 spur-gears running in oil-baths within the streamlined " sponsons."

By far the most interesting model seen at the 1953 Nationals, however, was the R.T.D. Special, built by its designer, Ken Robinson of the Medway Club, for a total cost of 2s. 6d. ! Mr. Robinson has for several seasons been a doughty champion of the " Tiddler " classes, and of home construction of both engine and car, and has probably carried out more intensive experiment in this sphere than any other private enthusiast. I have, therefore, asked Mr. Robinson to provide MODEL ENGINEER readers with intimate details of his car, aptly named. " The Flying Flue " !

It will be appreciated by readers that the R.T.D. Special is still in course of development, and that certain tuning secrets are of necessity withheld, but the clever design and freshness of approach to the problems involved will, I feel sure, be of interest to model engineers generally, and may even convince some sceptics that model racing car design is far from reaching stagnation !

The car as run at the 1953 Nationals was in its original experimental form, and was designed in co-operation with Mr. G. Thomson of the Medway M. & E.E. Society, with a view to developing the possibilities of straight internal flow characteristics, taking advantage of high density air at the nose, ducted direct to the carburettor, in a car with the smallest possible frontal area. The frontal area of the body, excluding wheels and axles, is, in fact, 0.834 sq. in.! This result was achieved by using turned units throughout, enabling modifications to diameters, areas and lengths to be easily carried out. The rear unit, which consists of the engine itself, lying horizontally with head to rear, is spigoted to the front, or tank unit. This consists of two concentric tubes, the inner one forming an extended inlet pipe from the nose to the carburettor, and the outer forming the actual fuel tank. A ballast weight forms the nose block, and carries the streamlined front axle.

The carburettor feeds direct into the crankcase, thereby eliminating bends in the induction system, and assists in reducing frontal area. Three-port transfer and exhaust system was chosen with a view to giving maximum port area by reducing the number of bends between the ports from eight to six. Exhaust gases pass along ducts milled axially along the cylinder barrel, enclosed by the outer sleeve, which forms an internal megaphone. A particularly ingenious feature of the design is the large conical-headed compression adjuster, which fulfils the additional purposes of cylinder head fairing and flow straightener.

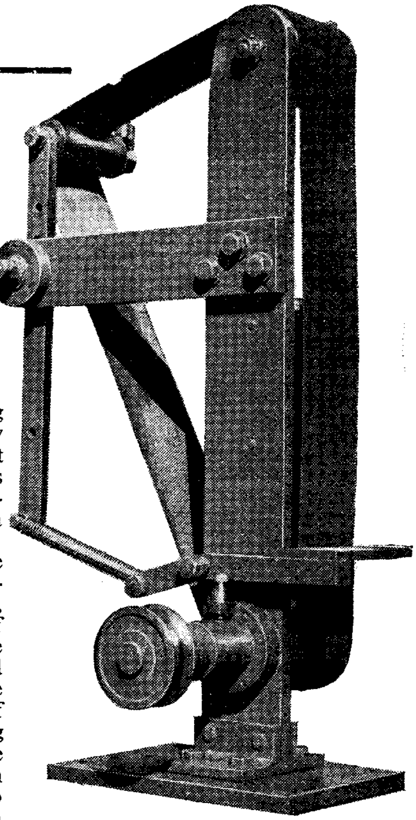
The outer wheel bearings are buried inside the hubs, to which the tyres are moulded direct, the front tyres being of streamlined section.

Although the engine is already capable of very high r.p.m., Mr. Robinson feels that there is much more power to come, whilst the car is still troubled with a certain amount of rear end instability, but experiments continue, and the car is likely to be giving a good account of itself during the coming season.

Despite the fact that this little racer has not yet reached its full state of development, I have chosen it as representing the modern trend towards extreme simplicity and functionalism in small capacity racing, and as a fascinating contrast with the successful " Tiddlers " of earlier years. I am indebted to Mr. Robinson for the details of its construction, and also for the excellently explanatory cutaway drawing.

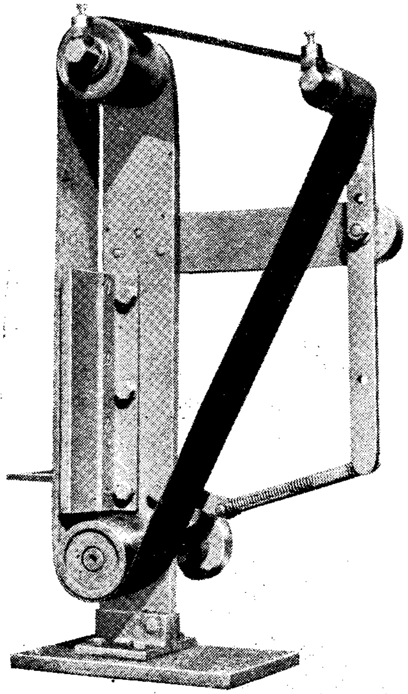
A BAND FINISHING MACHINE

By "Finsbury"



IN September, 1950 THE MODEL ENGINEER (Vol. 103, No. 2575) contained a review of a commercial abrasive band finishing machine, and this article gave me the urge to get one for my own workshop. Some weeks later, walking round London, I saw one of these machines in a toolshop window. However, nothing was done about it then, the shop was closed and the matter was more or less shelved for the time being. In May, 1952, Mr. A. R. Turpin described his machine, and the urge was so intensified that I decided to make one for my own use.

Obviously the first thing to do was to get some bands. Mine were obtained from Buck & Hickman (usual disclaimer) and are 36 in. in circumference and 4 in. wide. They are cut up the middle to make two bands, each 2 in. wide. Fraying of the cut edge has not given any trouble at all. The size is just right for small jobs, and the machine has given very great satisfaction, imparting a fine finish and saving a terrible lot of filing.

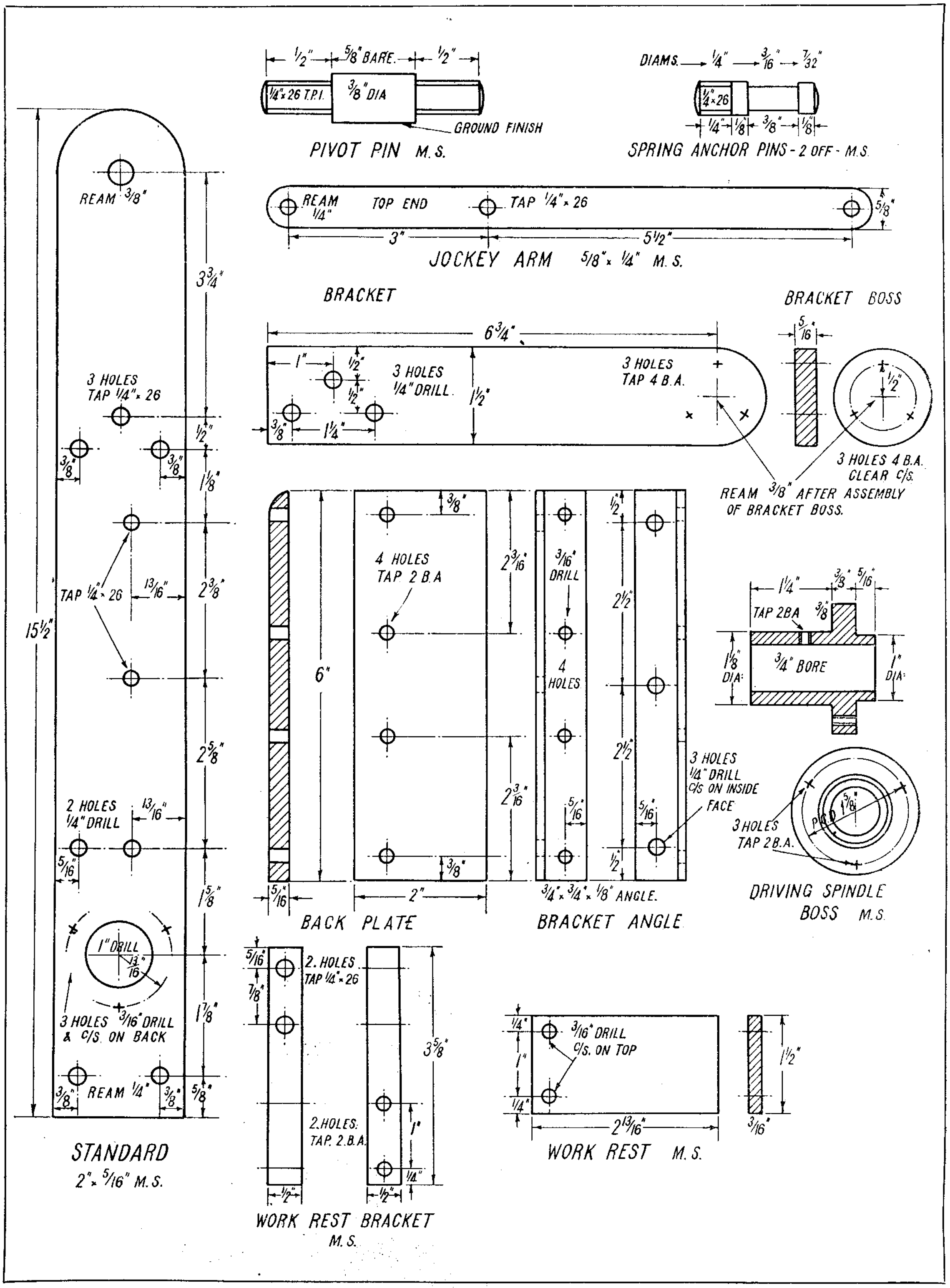


No castings were used, all the material being in stock in my workshop racks at the time. Hence the, perhaps, awkward proportions of some of the items. The machine "grew" as the various bits and pieces were sorted out from the racks and shelves, only a couple of very rough free-hand sketches being made prior to its construction. The pieces were laid out on the bench and moved around in relation to the standard and each other, with a band in place, to get something like reasonable proportions. It will be noticed that with the triangular track of the band, due to the bottom angle being the most acute, the largest contact area of band to roller is on the driving roller. This gives a very satisfactory grip, and although the band *can* be made to slip by heavy pressure, the art of all grinding is to press lightly, and let the abrasive do the work. When the bits and pieces were arranged to suit these ideas, measurements were made (to the nearest $\frac{1}{8}$ in.) and work was started. The completed machine is as it appears in the photographs, for which I am indebted to Mr. J. S. Streatfield. The drawings were made only for the purpose of this article.

The machine is, overall, 6 in. wide, $9\frac{1}{2}$ in. deep and $16\frac{1}{2}$ in. high, and it weighs $14\frac{1}{2}$ lb. It sits nicely under the end of the countershaft brackets for the Pratt & Whitney small bench milling machine, and is painted with "Dulac" to match this and the Myford M.L.7 lathe. It makes a very pleasing as well as a very useful addition to the workshop.

The consumption of bands is very low, both halves of the first band purchased in May, 1952 still being serviceable. The drive is from a 1/3 h.p., 230 V, 1,450 r.p.m. d.c. motor (suppressors are fitted) with a speed step-up of 2 to 1. This gives a linear speed of band of 1,500 ft. per min., which seems to work well in practice. Despite the plain bearings and the overhung drives, no "slop" has appeared to date. However, I would strongly recommend a modification to any who may consider making one for themselves. Enlarge the hole in the standard for the drive boss to $1\frac{1}{8}$ in., enlarge the one end of the boss to fit and the other to match, bore of the boss to be enlarged to suit, and the P.C.D. of the three 2 B.A. holes to be increased accordingly. This will allow of P/B bushes with more "meat" in them to be fitted. A further improvement would be to fit screw-down greasers to the idler and jockey pins, instead of the angled oilers with which my machine is fitted.

The main driving and idler rollers are crowned to centralise the band, and were finish-turned on centred mandrels, both being drilled and tapped $\frac{1}{4}$-in. B.S.F. for the securing screws. In the driving roller, this hole is used to fix it to the spindle by means of an Allen screw. That in the idler roller, after it is finished, is plugged to prevent oil leakage, by screwing in tightly a stud of brass, cutting it off and filing flush

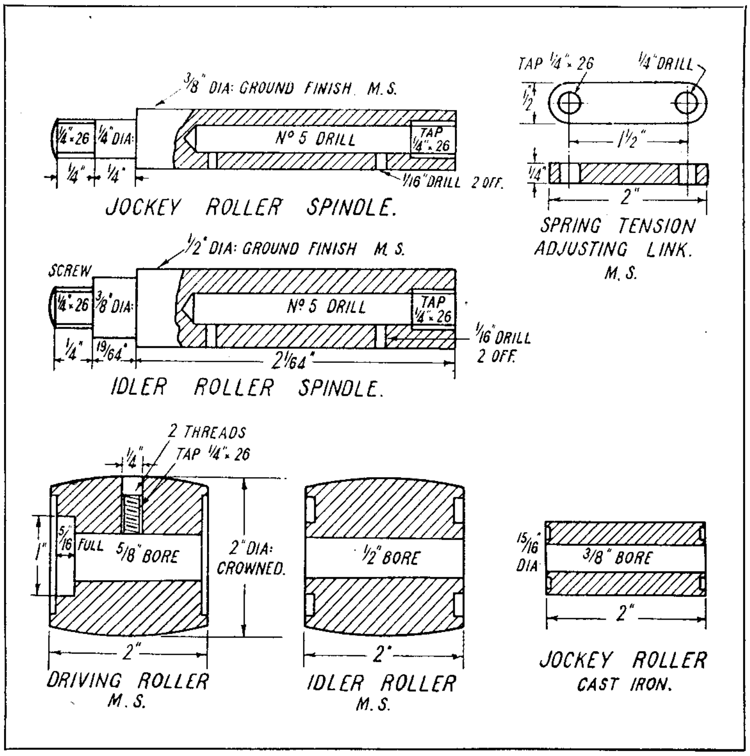

PIVOT PIN M.S.
1/2" 5/8" BARE 1/2"
1/4" x 26 T.P.I.
3/8" DIA
GROUND FINISH
SPRING ANCHOR PINS - 2 OFF - M.S.
DIAMS. 1/4" 3/16" 7/32"
1/4" x 26
JOCKEY ARM 5/8" x 1/4" M.S.
REAM 1/4"
TOP END
TAP 1/4" x 26
3" 5 1/2" 5/8"
BRACKET
6 3/4"
3 HOLES 1/4" DRILL
3 HOLES TAP 4 B.A.
1 1/2"
BRACKET BOSS
3 HOLES 4 B.A. CLEAR C/S.
REAM 3/8" AFTER ASSEMBLY OF BRACKET BOSS.
STANDARD 2" x 5/16" M.S.
REAM 3/8"
3 HOLES TAP 1/4" x 26
TAP 1/4" x 26
2 HOLES 1/4" DRILL
1" DRILL
3 HOLES 3/16" DRILL & C/S. ON BACK
REAM 1/4"
15 1/2"
BACK PLATE
4 HOLES TAP 2 B.A.
6"
2"
BRACKET ANGLE
3/16" DRILL
4 HOLES
3/4" x 3/4" x 1/8" ANGLE.
3 HOLES 1/4" DRILL C/S ON INSIDE FACE
DRIVING SPINDLE BOSS M.S.
TAP 2BA
3/4" BORE
1 1/8" DIA
1" DIA
3 HOLES TAP 2B.A.
P.C.D. 1 5/8"
WORK REST BRACKET M.S.
2. HOLES TAP 1/4" x 26
2. HOLES. TAP. 2.B.A.
3 5/8"
WORK REST M.S.
3/16" DRILL C/S. ON TOP
2 13/16"
1 1/2"
3/16"

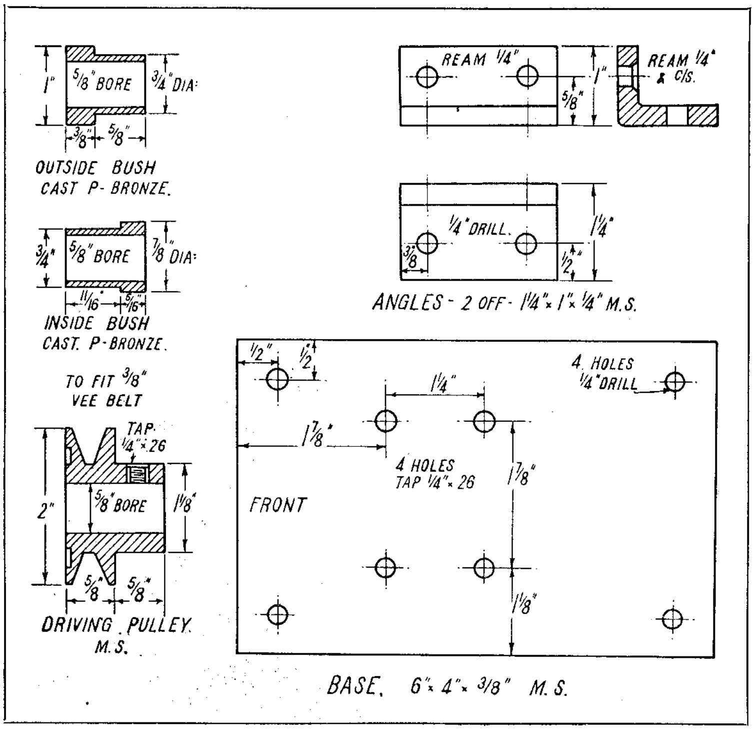
to roller contour. The jockey roller is left parallel, and because of its higher speed, due to its smaller diameter, was made from a stick of cast-iron and lapped to fit the ground-finish mild-steel pin on which it revolves.

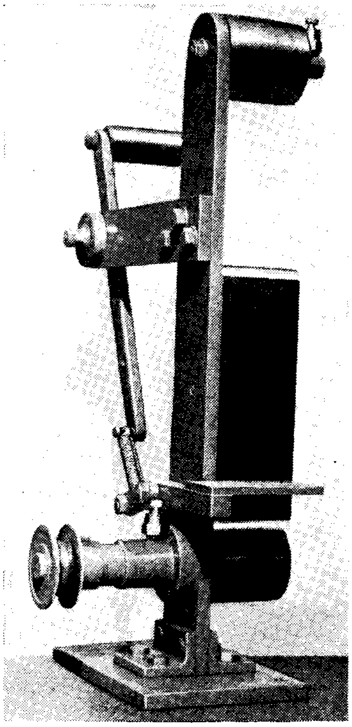
The bracket is fixed to the standard with three $\frac{1}{4}$-in. B.S.F. set-screws with hexagon heads. Perhaps countersunk ones would have been neater, but these I had, so I used them. The disc at the back end of the bracket is to give a longer bearing to the rocking pivot of the arm carrying the jockey roller. The pull of the band tends to twist this arm, and although the pull of the spring in some measure tends to twist it the other way, it was felt that a longer bearing surface than $\frac{5}{16}$ in. was desirable. For the same reason, the pivot pin is screwed into the arm, and lock-nutted, so that the pivoting action takes place between the pin and the reamed hole in the thickened-up portion of the bracket, instead of between the pin and the arm itself.

The spring tension can be varied widely, by adjusting the position of the anchor arm on the end of the screw holding the work-rest bracket to the standard. As this set-screw

(*Continued on page* 665)





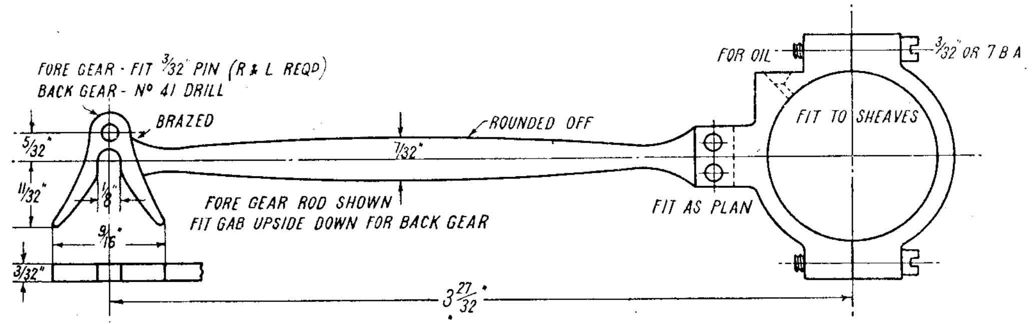


L.B.S.C.'s Titfield Thunderbolt

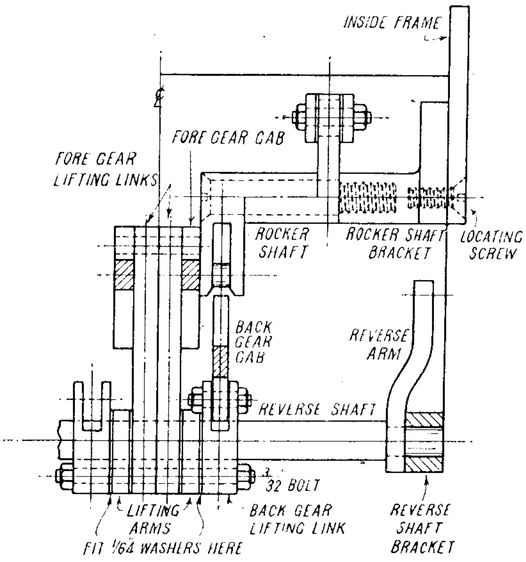
IN 3½ AND 5 INCH GAUGES

HERE, as promised, is a separate set of drawings for the 3½-in. gauge motion. Getting out three sets of drawings for the valve-gear for this engine, one for loose eccentrics, and two lots of gabs, has been a real dose of "hard labour" for your humble servant; and I fully realise why some writers fight shy of drawing out a complete valve-gear, or even a general arrangement of the engine with the valve gear on it. It's worth any excuse to get out of the job, as the schoolboy said when he dodged his homework by pleading toothache! However, you can bet your last dollar, if you have one, that Curly wouldn't be leaving the followers of these notes to "grope in the dark," in a manner of speaking; the detailed illustrations are proof enough of that. New readers sometimes ask how I set about designing a valve-gear, and what formula is used. Bless their hearts and souls, I don't use any formula at all. Boiled down to the rock bottom of simplicity, a valve-gear is simply a means of moving a slide-valve or piston-valve in such a manner, that it opens and closes the ports in the cylinder, to the right amount at the right time. As long as anybody knows the "when and how much" that their locomotive needs for efficient working, the rest is just a matter of ordinary common-sense; I find it so, anyway!

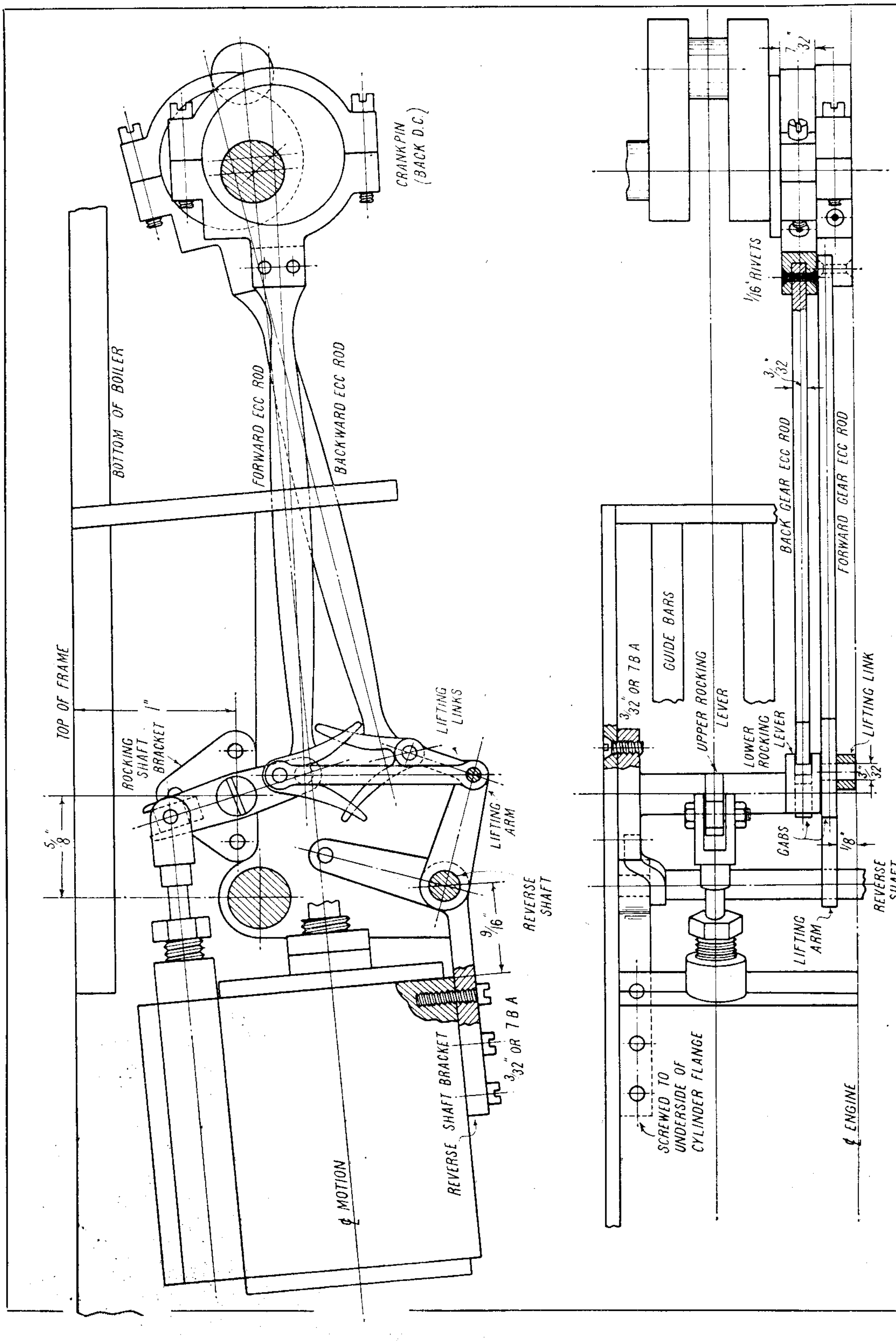
There is, of course, a "scientific" way of doing the job; for example, you can find a very fully detailed explanation of how to set out a Stephenson link motion, in Zerah Colburn's well-known work on *Locomotive Engineering*; variations of this have appeared in other journals from time to time, complete with all the "roly-poly" and other diagrams. I "read, marked, learned and inwardly digested," it, many years ago, but I've never bothered to apply the recommended method to my own work. Life's too short! If I want to design a link motion, I just hang up my links in the handiest place, and arrange my eccentrics, rods, lifting links, reverse shaft and all the rest of the blobs and gadgets, to suit. The funny part about it is, that it always works, and the engine gives as good, or better performances, than if I'd spent weeks on drawing out diagrams and making calculations. Maybe it is because Nature gave me the priceless gift of visualising the finished job, but there it is! Should I be in any doubt, I just rig up a kind of "working diagram" with a few strips of cardboard and some drawing-pins, and try it with a valve marked on the edge of a strip cut from a postcard, sliding over a set of ports pencilled on the remainder of the card. Primitive enough, I grant you, but if it faithfully reproduces the valve events (which it does) why go to elaboration?



Eccentric strap, rod and gab for 3½-in. gauge engine

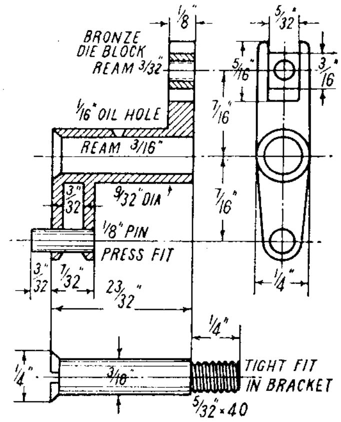


End view of gab motion for the 3½-in. gauge engine



Elevation and plan of gab motion for the 3½-in. gauge engine

The principle, and general proportions of the gab motion on the $3\frac{1}{2}$-in. gauge engine, are exactly the same as on the 5-in. version; so there is no need to repeat the whole ritual. All I need do, is just to call attention to slight variations in detail; all the measurements for the $3\frac{1}{2}$-in. gauge job are clearly marked on the accompanying drawings, and builders should have no trouble in making the parts and erecting them, in the same way as described for the larger engine three weeks ago. The bracket which carries the rocking shaft, can be made from a casting, or built up, as before, but it is tapped in two different sizes; the smaller is for the locating screw, and the larger, for the screwed end of the bearing-pin. I made this as large as possible, for extra strength on account of the overhang. Note that



Rocker-shaft and pin

the head is countersunk, and bears against a countersink in the end of the rocker. The rocking-shaft itself can also be made from a casting, or built up, as specified for the 5-in. gauge job; but in the smaller size it could, if preferred, be cut from the solid. A piece of bronze, gunmetal or hard brass bar, of $\frac{1}{4}$ in. $\times$ $\frac{3}{4}$ in. section, $1\frac{1}{4}$ in. long, would be needed for each. Saw roughly to outline, drill and countersink the hole for the bearing pin, and mount it on a stub mandrel, just a bit of steel rod turned a tight fit. Chuck this in the three-jaw, and turn the centre part of the rocker to a full 9/32 in. diameter. If the end of the stub mandrel is supported by bringing up the tailstock, the slot can be cut in the lower arm, with a parting-tool; but watch your step and don't feed in too much at a time, or there will be a crack, some railroad Esperanto, and a visit to the grinding-wheel. Finish off the arms to outline with a file. If the hole for the pin in the lower arm is drilled No. 34, the $\frac{1}{8}$-in. silver-steel pin should be a good press fit; alternatively, the outer side of the fork can be drilled $\frac{1}{8}$ in. and the inner one drilled No. 40 and tapped $\frac{1}{8}$ in. or 5 B.A., the end of the pin being screwed to suit. It must fit very tightly. When erecting the rocking shaft and bracket, note that the screws fit into tapped holes in the bracket flange, no nuts being required. After drilling and countersinking the three No. 41 screw holes in the frame, as described for the 5-in. gauge engine, and temporarily fixing the bracket with the locating screw, poke the No. 41 drill through the holes in the frame, and make countersinks on the flange of the bracket. Follow up with No. 48 drill, going right through the flange, tap 3/32 in. or 7 B.A. and put countersunk screws in.

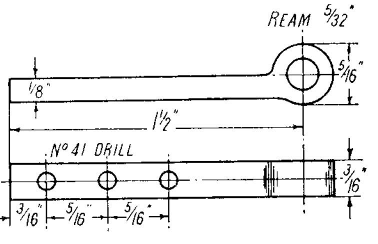
Eccentric-rod Assembly

The eccentric-straps are machined up and attached to the rods as already described; but note that whilst the forward-gear rod is riveted into a rebate cut in the side of the lug, the backward-gear rod is riveted into a groove cut in the middle of the lug. This is to enable straight eccentric-rods to be used. I hate bending valve-gear rods when it can be avoided, and often use offset forks to that end. The gabs are sawn and filed to the given sizes, from 3/32 in. "gauge" steel or mild-steel, and brazed to the eccentric-rods as described for the larger engine; 3/32-in. lifting pins are fitted to the forward-gear gabs, and No. 41 holes drilled in the backward-gear gabs. Don't forget when fitting the rods to the forward-gear straps, to make one right-hand and one left-hand, otherwise when erecting, you'll find that one strap is upside down, with the oil-hole at the bottom.

I tried to work in thicker gabs and eccentric-rods, but space is much more limited on the $3\frac{1}{2}$-in. engine, than on the 5-in. The thickest gabs that would fit in, were the 3/32 in. as shown. However, if hardened, they should last for years; see last instalment for instructions on the method of hardening them.

Reversing Shaft and Brackets

The reversing-shaft, complete with brackets and lifting-links, is merely a smaller edition of the shaft on the 5-in. gauge engine, except for the slightly offset bosses on the brackets; it is made and fitted in the same way as described previously. There is one point to note; when assemoling the lifting-links on the long bolt through the lifting arms, put a 1/64-in. washer, $\frac{3}{16}$ in. diameter, with a No. 41 hole in it, between each short forked link and the arm. Also make certain that the nuts on the ends of the long bolt come up

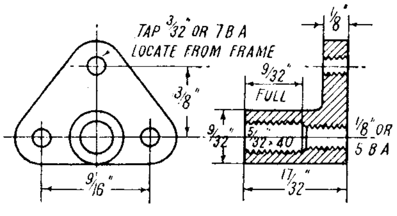


Reverse-shaft bracket

tight enough against the bunch of links, to allow free oscillation without any side wobble. If they do wobble, the backward-gear gabs won't smack up right home on the pins, between the jaws of the fork, when the lever is reversed. To get the gabs to line up exactly with the jaws of the fork, is merely a matter of careful fitting. The bolts are made from 3/32 in. silver-steel, with the ends slightly reduced, and screwed 9 B.A. Use ordinary commercial nuts.

Erection and Valve Setting

The erection of the $3\frac{1}{2}$-in. gauge engine's gear, and the method of setting the valves, are exactly as described in detail for the 5 in. gauge engine; so all you have to do, is to turn back to the last instalment of the serial. I noticed when checking over the drawings of the $3\frac{1}{2}$-in. gauge cylinders, that I didn't show any fork or valve-spindle



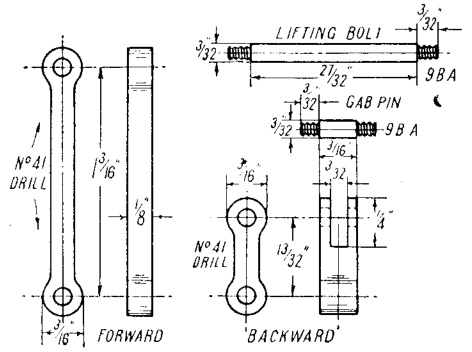
Rocker-shaft bracket

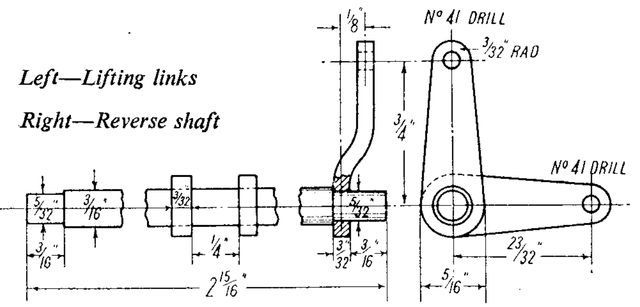
crosshead, so have remedied the omission here. The fork is made from $\frac{1}{4}$ in. square steel, by the process that I have already described umpteen times, so needn't repeat here. If the instructions mentioned above, for adjusting and setting the valves, are faithfully followed, there shouldn't be the slightest difficulty in doing the job and getting it right first time.

Test with a tyre pump, as recommended for the larger engine. Our next jobs will be, to see about a drop of oil for the cylinders and valves, and to fit a handle for reversing the gear from the footplate.

Wishful Thinking

Now and again I receive a letter from somebody who wants to build a 5-in. gauge locomotive, and asks if I can supply fully-detailed notes and drawings for something really hefty, such as a four-cylinder L.M.S. *Duchess* or a G.W.R. *King*. They invariably add that " they are certain that such a description would be welcomed by the vast majority of our readers." Well, I'm sorry to have to reply that they are just indulging in a bit of " wishful thinking," because the " vast majority " of the readers who look to these notes for instructions on locomotive building, have repeatedly asked me to describe engines which can be built cheaply, quickly, and are not too big. Large engines are also unwieldy to lift and handle, and awkward to cart around. Many are finding that the 3½-in. gauge *Britannia* is as big and heavy as they want to tackle ! One of the " W-T's " recently sought to clinch his argument by stating that he had a fully-equipped workshop, oxy-acetylene apparatus, and what-have-you, so could easily build a 5-in. gauge *Britannia* or *Duchess*; it didn't matter about his not having any track to run such a locomotive, as he could easily take the engine on his car, to a club track for running. He was quite sure that many others could do the same; and as to the cost being prohibitive, average wages were now around £9 per week, and young fellows thought nothing of spending up to £300 on motorcycles. He seems to have quite overlooked the fact that £9 a week doesn't leave much for hobby-spending nowadays, when the wage-earner has a wife and three or four kiddies to keep; and the young fellow isn't going to put his motorbike in the coal shed and start building a 5-in. gauge locomotive—not on your life !



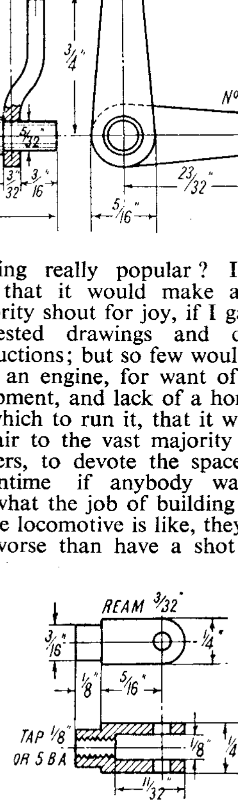


Left—Lifting links

Right—Reverse shaft

What are the facts ? Some time ago, in response to many requests for a simple and easily-built 5-in. gauge job, I got out designs for two of them; a Southern Railway 4-4-0 of Class L1, and an 0-6-0 of the old " Brighton " Vulcan tupe, as rebuilt. They were arranged to be made as simply and cheaply as possible, but without any sacrific of efficiency. What was the result ? Prospective builders started off with a terrible rush, but alas ! Tales of woe soon began to come in. The first headache was the driving wheels of the 4-4-0 (*Maid of Kent*); many home-workshop lathes shied badly at turning the 7 in. castings. From correspondence received, I should estimate that at least 90 per cent. of the coupled wheels were turned as " homework " in various works and engineering establishments. Then the cylinder castings presented a machining problem for smaller lathes; and when it came to to the boilers, there were moans indeed ! The terrific cost of the copper sheet and tubes, even when readily obtainable, and the trouble in brazing with the average home equipment, caused some builders to give up in despair, and go in for something smaller. Those that were finished—patience, perseverance, and *pockets* did manage to " stick it out " in many cases—proved plenty heavy enough to lift about with comfort, single-handed; and it needed something a little roomier than an " Austin Seven " to cart them around for running on club tracks. Not many folk have back gardens suitable for 5 in. railways.

I also described, in a contemporary journal, how to build a 5-in. gauge 0-6-0 shunting tank engine of the G.W.R. 1500 class, the last design before nationalisation. She was only a comparatively small engine, the wheels, cylinders, and boiler being quite moderate in dimensions; but it took readers all their time to build her, and taxed most of their resources to the utmost. She didn't prove nearly as popular as the 3½-in. gauge engine which I had previously described. If these fairly small jobs entailed too heavy work, and proved too costly, what hopes would there be, of a huge 5-in. gauge Pacific proving really popular ? I grant you that it would make a small minority shout for joy, if I gave the requested drawings and detailed instructions; but so few would build such an engine, for want of funds, equipment, and lack of a home line on which to run it, that it wouldn't be fair to the vast majority of our readers, to devote the space to it. Meantime if anybody wants to see what the job of building a 5-in. gauge locomotive is like, they might do worse than have a shot at the



Valve spindle fork

three mentioned above. Full sets of blueprints of the *Maid of Kent* (4-4-0) and the *Minx* (0-6-0) are obtainable from our offices; and Reeves and Kennion Bros. can supply blueprints for the G.W.R. 0-6-0 tank. There are also Reeves's own engine *Gert*, and Kennion's *Butch*, both powerful 0-6-0 tanks which incorporate many features described in these notes, and which are simple and not too expensive to build.

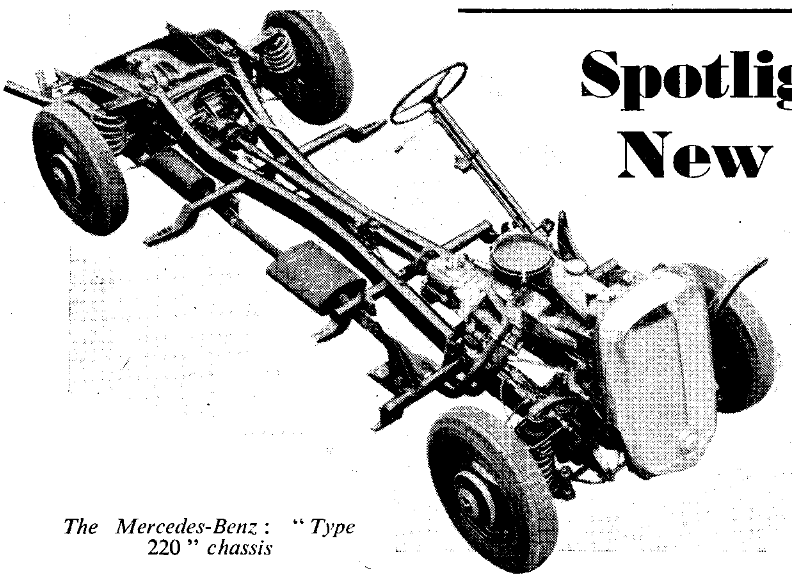
Most folk, when they build a locomotive, want to run it on their

(*Continued on page* 662)

Spotlight on New Car Designs

SOME INTERESTING TRENDS REVIEWED

By J. Dewar McLintock



The Mercedes-Benz: "Type 220" chassis

THOSE interested in the mechanical characteristics of the motorcar have been provided with more than ordinary interest in certain features of the 1954 models as shown at the recent Earls Court Motor Show.

It is not the intention here to consider utilitarian or aesthetic trends and indeed these have already been made almost universally familiar through the agency of advertisements, the national and motoring press, and the show itself—which is always so crowded that anyone who wishes to study technical matters becomes maddened or frustrated after a visit to just one or two stands. . . .

It cannot be pretended that there is, as yet, a truly revolutionary motorcar. The gas-turbine Rover is still a curiosity—albeit a potent, most effective one—and there is not as yet any sign of that kind of hydraulic drive direct to the wheels, which was, the writer believes, the subject of a patent by Austins two or three years ago. There is no car which measures up to the desire for something equivalent to the Comet aircraft, as expressed by the Duke of Edinburgh. Nevertheless, there has probably been more evidence of technical development this year than there has been since the late pre-war and early post-war years.

As has always been the case, one must fairly admit, the European designers lead the way, but many British designs show a nice compromise between the reserved and the advanced techniques.

The big story of the year has been in the "baby" car field, where price cuts and austerity designs have brought motoring within the reach of very many more people, but there are no real technical advances in that field. It is mainly among the sports cars that one can see really interesting trends, and one of the most notable is the use of glass-fibre for body construction. This technique, whilst having been employed in the United States for a number of years, is quite new to England as far as commercial production is concerned.

There are two main reasons why the use of glass-fibre is confined to the sports-car field. In the first place, it is very light in weight. It is also easily worked and processed which means that bodies can be made cheaply and with the use of comparatively unskilled labour, but *not* by mass production, as would be necessary in the case of, say, a popular saloon. Quantity production is not necessary or even desirable in the case of short runs of specialised cars.

Singers showed their Export Roadster with complete glass-fibre body. It looked very handsome in cream, with red upholstery, and the finish was certainly equal to that of a conventional metal body, if not better. There were no evidences of roughness in moulding, even on concealed edges of the shell.

The complete body is made in five sections, i.e. front and rear, a narrow scuttle, and the two doors. Also in plastic are the wheel-arches, instrument panel, glove boxes, spare-wheel cover and petrol-filler cover.

Perhaps the greatest technical interest in this assembly, however, lies in the bonding of the light-alloy floor to the body, and the bonding of the shell itself to tubular steel stanchions bolted to the chassis.

The use of glass-fibre was also seen in the case of the Jowett R.4 Jupiter Sports, the example at the exhibition making use of this material as well as a certain amount of steel panelling of normal type. It is likely that production runs will be made with the use of plastics for all panels except the scuttle. Both these manufacturers, incidentally, make much of the fact that this material is easy to repair.

In the new Ace sports model, A.C. Cars Ltd. have tackled the problem of weight reduction seriously. In this case the two-seater body is panelled in aluminium over a framework of steel tubes. The chassis is of ultra-lightweight type, the main frame being of large-diameter light-gauge steel tube.

The Ace has independent suspension front and rear, by means of transverse leaf springs and wishbones. Some students of design see in this, and in the suspension of the new Riley Pathfinder, a definite pointer towards the more general employment of coil, torsion-bar or transverse-leaf rear-springing, already pioneered by a number of Continental and one or two British manufacturers. The Riley—a high-performance 2½-litre saloon—uses long coil springs with concentrically-mounted dampers of hydraulic type, the rigid axle being located by means of long radius arms and a transverse link.

In general, there is a strong accent on performance—so much so that the highly dignified Daimler company has come into a considerable blaze of publicity with the Conquest Roadster—a sleek and glamorous but 100 per cent. practical fast two-seater. The story behind the headlines, here, is in the modified 2½-litre engine, which now has a special aluminium cylinder-head, giving a

compression ratio of 7.75 to 1, a high-lift camshaft, overlap timing and larger valves. These traditional aids to greater performance allow an increase in b.h.p. from 75 at 4,000 r.p.m. to 100 at 4,600. This means, according to Sir Bernard Docker, that the maximum speed is well in excess of the hundred. This magic figure is quoted, too, for the A.C. Ace, the Jowett Jupiter R4, and the new Riley Pathfinder and Alvis Grey Lady saloons, as well as for many machines which have already distinguished themselves in open competition in the past.

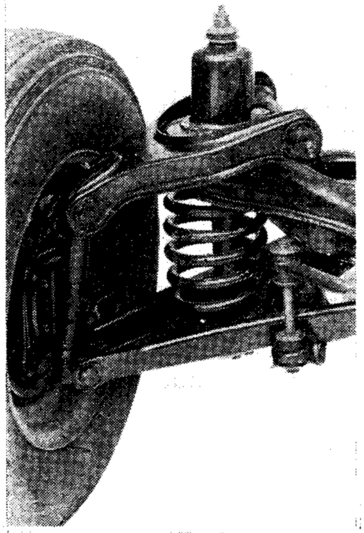
It is of more than passing interest to consider how such high performance figures are being obtained from power units which are not hand-fitted, nor indeed far-removed from normal quantity-production units. The main reason, in most cases, is the existence of a high power-to-weight ratio. This characteristic has been made possible by the use of light bodies such as those already described; light tubular or box-section chassis; integral construction of body and chassis; use of light metals such as Dural and various aluminium and magnesium alloys; and "paring down" of unnecessarily heavy castings and sections.

Digressing for a moment, it is interesting to note that the same kind of thing is happening in the commercial vehicle field, although for a very different reason. In this case the crippling fuel tax is forcing weight reductions upon manufacturers, but with less fortunate results, because durability may well be affected, whilst export orders may be lost because neither chassis nor bodies may be sufficiently strong, at any rate for really tough conditions.

The power units themselves of these high-performance cars are more potent because there has been greater attention to obtaining the maximum volumetric efficiency. Cylinder head and inlet-tract designs are improved, whilst another important factor is that compression ratios have been raised in many cases, this having been made possible by the re-introduction of high-octane petrol.

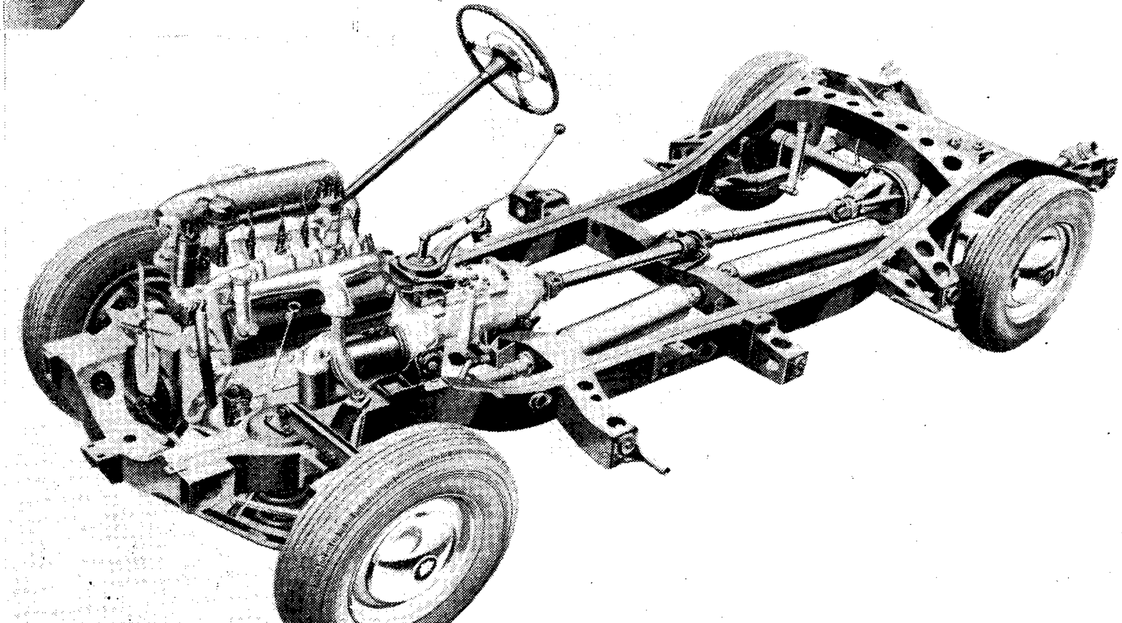
Turning from the general to the particular, some data on current power units may be of interest. The 2-litre six-cylinder engine in the Daimler Roadster has a compression ratio of 7.75 to 1 (compared with 7 to 1 in the standard saloon) and develops 100 b.h.p. at 4,600 r.p.m. The Riley $2\frac{1}{2}$-litre six-cylinder engine develops 102 b.h.p. with a compression ratio of 7.25 to 1. (Incidentally the hemispherical head which was such an excellent feature of the first o.h.v. Riley engine in 1928 is still used.)

The 2-litre six-cylinder A.C. engine develops 85 b.h.p. which is in keeping with its smaller size. In the $1\frac{1}{2}$-litre class, the Jupiter shows 64 b.h.p. at 4,300 with a compression ratio of 8.5 to 1, and the Singer SMX is quoted as giving 58 b.h.p. at 4,600 with 7.4 to 1 ratio—the



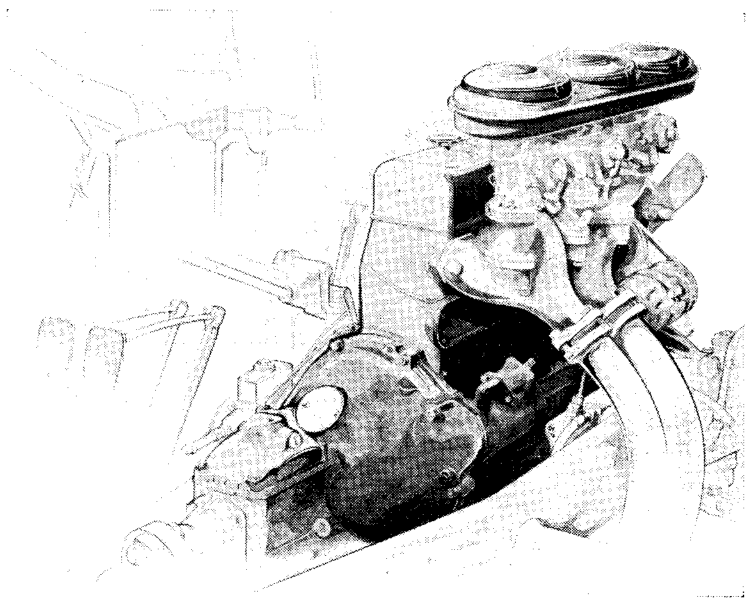
Left: *Front wheel suspension of the new Mercedes-Benz, "Type 180"*

Below: *The Rover "90" chassis*



quoted maxima being respectively "over 100" and 90 m.p.h. The Singer has the well-tried four-cylinder overhead cam unit—in many respects the same motor as that fitted to the successful 1½-litre Singer of the early and middle thirties. The Jowett has the unique horizontally-opposed "four" which is a direct descendant of the old flat twin, just as the Singer unit is descended from the loveable old o.h.-cam. 8 h.p. motor.

From the viewpoint of the student of design, there was also great interest in the comparatively new-found diversity of opinion as to where the engine should go . . . this applying mainly to Continental designs. It is true that there has been a representative of the rear-engine cult in England for a number of years, in the form of the little 750 c.c. Renault, but it is of French design, and the rear-engined Volkswagen which is selling in quite large numbers in this country now, is of course the original German People's Car. It is not merely a question of "front or rear" but of whether the frontally situated motor should project forward or aft of the front hubs. There is a tendency, on the Continent, to push it well forward, with excellent effect on accessibility and body space. In general, European engines are far more accessible



The 150 h.p. high-performance engine of the Mercedes-Benz "Type 300 S"

than ours, and are indeed sometimes made to wheel out with the drive and suspension units, or to come out on a kind of tray or sub-frame. These are perfect subjects, one would imagine, for the enthusiastic modeller, and many of the more progressive designs almost beg for reproduction in miniature, with their coil-spring and torsion-bar suspension, rack-and-pinion steering, and tubular or fabricated box-section frames, or single "backbones."

L.B.S.C.'s TITFIELD THUNDERBOLT

(*Continued from page* 659)

own line, as and when desired, and not have to cart it along to a club track, or a friend's road, before getting up steam. How many average suburban back gardens will accommodate a little railway suitable for a 5-in. gauge locomotive to show its paces? It is precious little fun, to open the regulator and then shut it again. Many of my correspondents raise a moan because their line is too short even for a 3½-in. gauge job. My own continuous track is not suitable for any engine larger than a 3½-in. gauge 4-6-0, and that needs a severe speed restriction around the curves. An L.M.S. or L.N.E.R. 4-6-2 won't run around the 17 ft. 6 in. radius of the south curve, on the 3½-in. gauge rail; the only 4-6-2 which *will* take it, is a *Britannia*. The full-sized engines were made specially flexible for the curves of the old Great Eastern main line, and this feature is reproduced in the little one.

One of our advertisers gives it as his opinion, that "5-in. is the coming gauge." I'm afraid he based that opinion on the fact that he has sold some castings for 5-in. gauge engines, and knows of a few cases where the engines have been finished and gave satisfaction; but from my own correspondence, I'll say that the cases were probably exceptional. He also says that the sales of castings for the 5-in. gauge *Titfield Thunderbolt* are much ahead of the 3½-in. size. I don't doubt *that* for one minute! The reason is, that the 5-in. "Tit" actually pans out smaller than an average 3½-in. gauge job, whilst the 3½ in. is only a wee thing, not as big as the average 2½-in. gauger. Personally, I would rather build the old-timer in 5-in. size, to dodge the "watch-making" bits; and I know of some *Invictas*, *Rainhills*, and others that have been enlarged up to 5-in. gauge, for similar reasons. *Per contra*, it is a significant fact that the smaller engines that I have described, have enjoyed the greatest popularity; wherever you go, you'll find examples of *Juliet* and *Tich*, and I guess these two have set up all-time records. The designs have also been used as bases for other types of locomotives, so as to make certain that the "works" were O.K. whatever their personal appearance! The last "foreigner" that ran on my road, only a few days ago, time of writing, was a *Tich* built by Mr. A. Marchant, and a smashing performance she put up, too, steaming and pulling like nobody's business. Incidentally, Mr. Marchant informed me that his little vacuum ejector, the mention of which, by another writer, started the discussion on vacuum brakes, was made in accordance with your humble servant's specifications; nuff sed!

In conclusion, if there should be sufficient demand for a really hefty 5-in. gauge locomotive, I would gladly give fully detailed instructions and drawings, including a general arrangement of the valve-gear, if approved by our good friend the Knight of the Blue Pencil, and my own circumstances permitted it. I can do it, just as well as I can do the 3½-in. and 2½-in. sizes; in fact, the larger drawings are easier to make, giving more room to play about in.

Any comments? Glad of'em!

Making MORSE TAPER ARBORS

By " Duplex "

ALTHOUGH Morse taper arbors can be obtained accurately ground to a high finish, they are expensive to buy and, moreover, the standard patterns may not be suitable for some particular purpose, such as mounting a milling cutter. The commonest form of Morse taper arbor is, perhaps, that used for mounting a drill chuck in the lathe tailstock barrel, or in the headstock mandrel, but arbors of this kind also provide a means of mounting milling cutters with great accuracy in the spindle of the lathe or milling machine. The projecting end of the arbor can be machined to fit the bore of the milling cutter, and this is important, as surplus cutters, having bores of metric size, can often be bought quite cheaply.

When the arbor for mounting the milling cutter is formed with a parallel shank, and is gripped in the self-centring or four-jaw chuck, the cutter itself will have considerable overhang; but, to obtain satisfactory machining, this overhang should always be reduced as far as possible, particularly in light lathes.

The Morse taper arbor, on the other hand, enables the cutter to be mounted close to the mandrel nose and, in this way, greater rigidity is obtained.

As a milling cutter, when in operation, is quite often cutting on one side only, the pressure on the teeth tends to loosen a tapered mandrel in its seating in the machine spindle; just as some mechanics are, regrettably, in the habit of removing a lathe centre by tapping it with a hammer from side to side.

To make sure that the arbor remains firmly in place, it is best secured by means of a threaded draw-rod passing through the headstock mandrel or tailstock barrel.

Machining a Morse Taper Drill Chuck Arbor

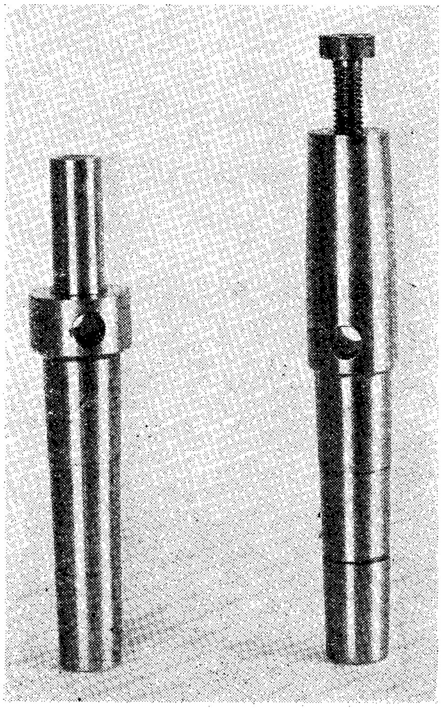
These arbors, either No. 1 or No. 2 M.T., are quite easily made in the workshop, and we have had no need to go to the trouble and expense of obtaining the commercial counterparts. Start by making a dimensioned sketch of the part, and then cut off a piece of mild-steel rod a little over the finished diameter and length.

If the arbor is to be removed by means of a tommy-bar, a hole should be drilled across the material at this stage.

Next, the rod is gripped in the self-centring or four-jaw chuck, with its end projecting far enough for the taper to be machined.

Face the end of the work, form a working centre with a centre-drill, and engage the tailstock centre.

In case this information is not available, a No. 1 M.T. has a taper of 0.3 in. per foot, measured from the axis of the arbor, and in a No. 2 M.T. this is equal to 0.301 in. per ft. Both these figures represent an included angle of slightly less than $1\frac{1}{2}$ deg; and the final, exact setting of the topslide must be arrived at by a process of trial and error. Where the lathe is fitted with a taper-turning attachment, there will, of course, be no difficulty in making a precise setting. The engraved



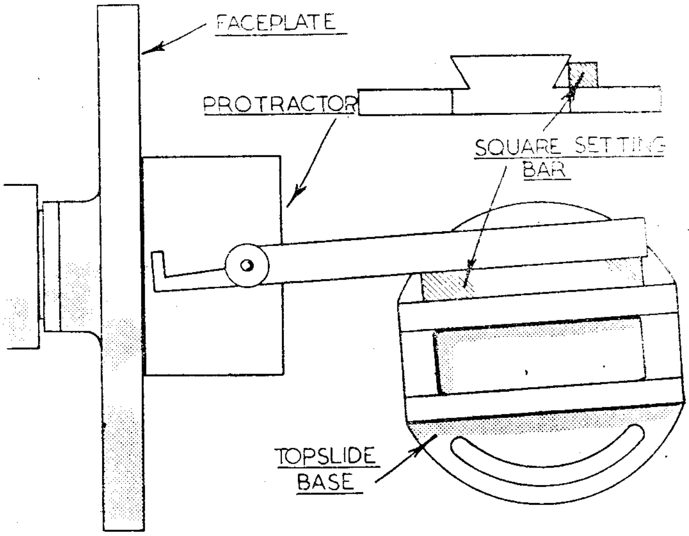


Fig. 2. Setting the angle of the topslide with a protractor

***Fig.* 1 (*left*). Two No. 1 Morse taper arbors made in the workshop**

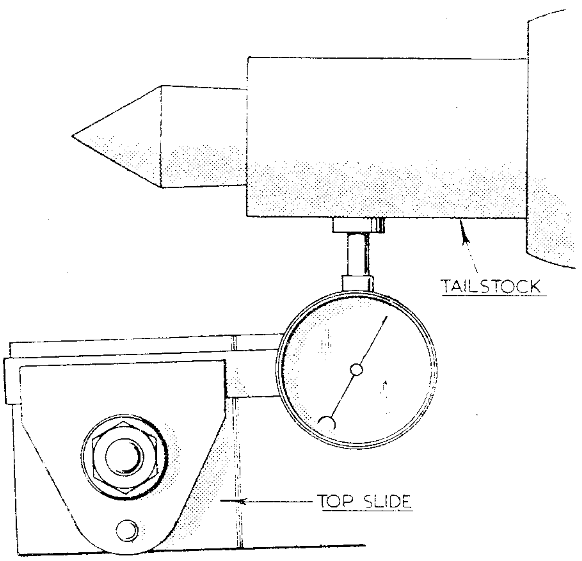


Fig. 3. Using the test indicator for making fine adjustments of the top-slide setting

scale at the base of the topslide may be referred to in order to make an approximate setting or, as shown in Fig. 2, a protractor can be used by applying the stock to the lathe faceplate and the blade to a length of parallel, rectangular material, resting against the pressure face of the V-way formed in the topslide base. However, it is almost certain that readjustment of the angularity of the topslide will be needed during machining, in order to form the taper correctly.

Therefore, as shown in Fig. 3, to obtain a fine adjustment of the setting, the test indicator is mounted on the toolpost and the plunger is brought into contact with the tailstock barrel; in this way, the topslide can always be returned to its original setting when making an adjustment, or any precise alteration can be made.

A pointed knife tool is now set with its cutting edge at exactly centre height and, with the lathe running at high speed and with the saddle locked, the topslide is used to feed the tool along the work, taking care to maintain a slow but regular turning movement.

By taking a series of light cuts, the taper is machined to a few thou. in. above the finished size. To check the angularity of the taper, a corresponding female taper is used as a gauge; a M.T. adapter or a suitable lathe fitting will do for this purpose, otherwise it may be found necessary to remove the tailstock barrel to serve in the same way. Draw a number of parallel pencil lines along the work or apply blue marking and, after applying the gauge with a slight twisting movement, the obliteration of the marks will indicate the areas of contact. Any correction of the top-slide setting is then made by rotating the slide base and noting the reading of the test indicator. After a correct fit has been obtained, the middle third of the taper can be reduced in diameter by a few thou. in., in order to guard against any rocking movement after slight wear has taken place.

The two arbors shown in the photograph have been treated in this way. Before returning the topslide to the normal working position, it may save time in future if a line is scribed on the cross-slide to denote the position of the topslide base.

An alternative method of setting the topslide is shown in Fig. 4.

Here, a short length of rod is gripped in the chuck and then centre-drilled; one of the lathe centres is now mounted between this hollow centre and the tailstock centre. The angular setting of the topslide is next adjusted, until the needle remains stationary while the test indicator, mounted on the toolpost, is traversed along the standard taper.

After the taper has been machined, the end of the arbor is drilled and then tapped 2 B.A. to take a draw-rod. To turn the taper forming the seating for the drill chuck, the arbor is reversed and mounted in the taper of the lathe mandrel nose, where it is secured in place by tightening the nut on the end of the draw-rod.

To ensure that the arbor is always mounted in the same position, it should be marked with a centre-punch, and a line to correspond is lightly scribed on the end face of the mandrel nose.

If the manufacturers state the angle of the taper formed in the base of the drill chuck, the topslide can be set accordingly, and any fine adjustment made, as before, with the aid of the test indicator. If this angle is unknown, it can be measured roughly in the following way. Set the inside calipers to span the diameter of the taper at the bottom of the hole and then measure across the points with the micrometer; repeat this at the large end of the taper, and then measure as nearly as possible the distance between the two points of measurement.

From these figures, calculate the taper in inches per foot and obtain the corresponding angle, either from a reference table or by trigonometry. The taper can now be machined to

(*Continued on page* 675)

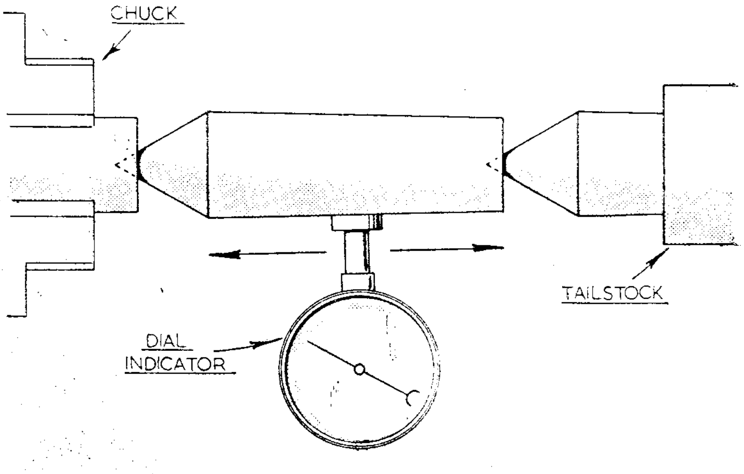


Fig. 4. Setting the angle of the top-slide from a lathe centre

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Converting Petrol Engines

I have an old four-cylinder car engine, with the cylinders in two separate water-cooled blocks of two cylinders each. One of these blocks is damaged, and it is proposed to cut the engine in two and make it into a twin-cylinder engine of half the capacity of the original. Please inform me if this is practicable, and whether the balance will be affected, also explain how the timing of the valves will have to be arranged.

T.B. (Pangbourne).

If the engine has a centre bearing for the crank, it may be possible to cut it in two and use two cylinders as you suggest, though there may be difficulties in re-mounting the flywheel or driving the timing gears, as these components are usually at opposite ends of the engine. As the cranks will be at 180 deg. to each other, this will produce unequal firing intervals, and although they will be in static balance, the dynamic balance will be poor, as a rocking couple is set up; this may be partially corrected by balance weights on the outer crank webs. The valve timing on an engine converted thus, would remain in the same relation to the cylinders as they were originally, so that the part of the camshaft serving the two cylinders which are retained can be utilised to give correct valve events.

Magnetic Properties of Iron

What is the most suitable kind of iron or ferrous alloy for the field-magnet of a small dynamo? I understand that it is nessary for the magnet to retain a certain amount of residual magnetism to enable the machine to be self-exciting. Is it practicable to use a cast-iron field, or alternatively, would a solid wrought-iron be the more suitable?

G.H. (Romford).

Both cast- and wrought-iron field magnets have been used successfully in small dynamos, the former being usually the less efficient in the magnetic sense, but tending to retain more magnetism. Modern practice tends towards the increasing use of laminated fields, in all kinds of electrical machinery, owing to the greater magnetic efficiency of the special alloys used for laminations. As these retain very little magnetism, however, it is often found necessary, when they are used in generators, to introduce one or more laminations of steel, hardened and tempered to produce permanent magnets. The alloys used for laminations are varied according to the purpose for which they are employed; most laminations for dynamos and motors contain a small percentage of silicon, but nickel, chromium and manganese are also used in modern magnetic alloys.

Motor Car King-pin Bushes

I wish to bush the king-pin bearings of an Austin 7 stub axle. I would like to know if close-grained cast-iron could be used for these bushes instead of the usual bronze.

H.F.M. (Amersham).

A good quality cast-iron would be suitable from the point of view of wear, but in view of the fact that these bushes would be subject to a certain amount of impact, cast-iron would be inferior to withstanding this to a good quality bronze.

In the circumstances, and particularly in view of the fact that personal safety may be involved, we think it would be more discreet to relace the bushes with the same metal as originally used.

Fitting Flash-light Bulbs

I wish to buy a tap or plug taps suitable for threading brass to take ordinary flash-light bulbs. I have tried ⅜-in. Whitworth, but this is not quite right. Can you give me the names of any firms who would be able to supply?

F.M. (Leigh).

We are extremely doubtful whether you will be able to obtain taps suitable for this purpose unless they are specially made.

The screwed cap on this type of bulb is made of sheet metal with the thread rolled by internal and external tools, and the thread form is different from that of threads which are intended to be cut in solid material.

In the circumstances, we regret that we are unable to advise you of anyone who could supply such taps, and although it might be possible to get them made to order, they would probably be very expensive.

A BAND FINISHING MACHINE

(*Continued from page* 655)

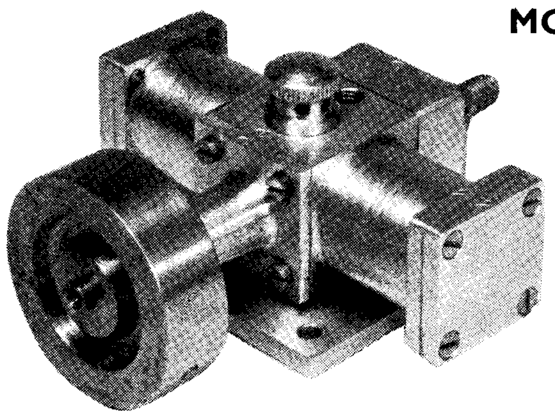
is screwed into the work-rest bracket, any adjustment of the spring tension can be effected without altering the angularity of the work-rest, which is fixed square both ways to the band travel, which is downwards towards the rest. The remainder of the construction can be seen in the photographs, and needs no comment.

Convex contours can be finished by pressing them against the band between the top of the backplate and the idler roller; then the spring will stretch, the jockey roller will come forward, the band will go in and follow the contour, and all you have to do is to hold the work square with the band.

Changing the band is quite simple. Push the bottom end of the arm, by the spring, backwards against the pull of the spring, and slide the band off to the right, dodging the angle oilers on the idler and jockey roller spindles.

No Complaints

The machine, as illustrated and described, has been in use for about 16 months, and I have no complaints to make about the way it does the job. It was simple to build, and has amply repaid time and trouble taken to get fair work and square into its construction. Having gained much benefit from articles by others in "our" journal, it was felt that a description of something I had made might be of use to others. Should any further details be required as to minor details, etc., contact through the editor will bring a prompt response, if return postage is enclosed.



MORE UTILITY STEAM ENGINES

The "Cygnet"

This instalment describes the concluding machining and fitting operations on this simple engine

By Edgar T. Westbury

IN order to reduce the weight of the pistons to the minimum, they are each made in two parts, an outer shell of cast-iron, and a yoke, to take the gudgeon-pin, of duralumin or similar light alloy. As an alternative, it is, of course, possible to make the pistons in one piece, but unless a good deal of intricate milling is done on the insides, they will almost inevitably be much heavier than if made as recommended. The use of light alloy for the working surface of the piston is not at all desirable, and if they are to be used without packing of any kind, cast-iron is the most suitable material here.

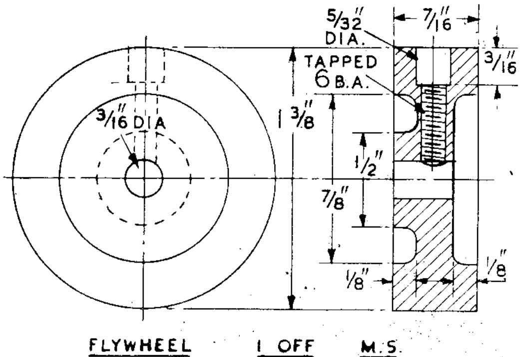
It may be said that, in general, one of the most common faults in small high-speed engines of all kinds is excessive weight of the pistons, resulting in balancing difficulties, and abnormal inertia loads on the working parts. While engines with heavy pistons can sometimes be made to run at high speeds, it is clear that an undue proportion of the internal horse-power developed must be absorbed in starting and stopping the reciprocating parts, and causing the entire engine to vibrate bodily; in other words, the mechanical efficiency is lowered, not to mention the abnormal wear caused thereby.

Continued from page 606, *November* 19, 1953.

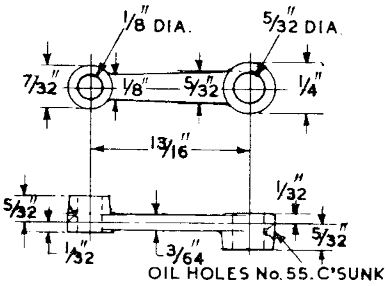
The outer shell of the piston is machined from cast-iron stick, and as will be seen from the drawing, it is only 1/32 in. in wall thickness all over. This sounds pretty fragile, but in fact it is quite robust for its intended purpose. The entire machining, including drilling and boring the interior, and turning the outside, can be done at one setting, prior to parting off, which may with advantage be left until the finishing of the surface is complete. It is an advantage to turn grooves in the outside, about $\frac{1}{8}$ in. apart, to assist in holding oil and producing a good seal; these obviously cannot be more than about 0.005 in. deep, but will be quite effective. The outside diameter should be left about 0.002 in. oversize (this may be checked from the bore of the liner by turning a plug gauge to a tight push fit and allowing "two up" on the measurement), and a split ring lap used for finishing the surface till the piston will just enter the bore. Any odd piece of copper or aluminium bar, about 1 in. diameter and $\frac{3}{8}$ in. thick, may be used for the lap; it is bored $\frac{1}{2}$ in. diameter, and cut through one side with a hacksaw. A carrier or die-holder will serve to hold the lap, and enable it to be adjusted to compensate wear; the lapping operation is similar to that described for the interior of the liners.

Piston Yoke

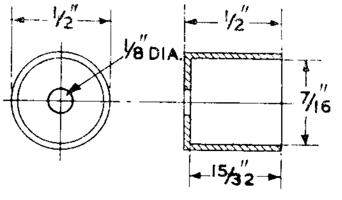
The easiest way to make this component is to turn and face the end of a piece of duralumin bar, to fit inside the piston shell, and carry out the cross-drilling and shaping of the lugs before parting off. Both ends of the bar may be turned in this way, so that the pair may be dealt with at one set-up. If a vertical slide is available the bar may be mounted horizontally across it, one of the the slots serving to ensure location, and enabling the work to be held by a single clamp; the slide is then set exactly square with the lathe axis, and the work adjusted to centre height for drilling and reaming the cross hole. Either a side-mill or an end-mill may then be used to slot the lug and cut away



FLYWHEEL 1 OFF M.S.



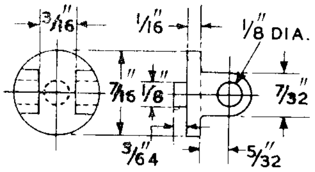
CONNECTING ROD 2 OFF DURAL



PISTON 2 OFF C.I.

surplus metal at the sides; for end-milling, the vertical slide will, of course, have to be swung round to bring the bar parallel to the lathe axis. A file may be used to round off the nose of the lug.

The bar may now be replaced in the chuck, and the yokes necked



PISTON YOKE 2 OFF DURAL

down at the back to $\frac{1}{8}$ in. diameter, a long enough piece being allowed to enable this to be measured accurately, and finally parted off to leave a spigot just long enough for riveting into the piston. This operation, however, cannot be carried out yet, but must wait until the connecting-rods are completed, as the use of "trapped" gudgeon-pins makes it necessary to assemble these parts permanently.

Connecting-rods

In view of the importance of making both rods exactly alike, in respect of length and other essential dimensions, I found it desirable to make the two in one piece, and separate them after boring the eyes and carrying out as many other operations as possible. A piece of duralumin, large enough to finish to $1\frac{1}{8}$ in. long by $\frac{3}{8}$ in. wide by $\frac{1}{4}$ in. thick, was first trued up on all faces, and marked out for the eye centres, which are $\frac{13}{16}$ in. apart. This was mounted on an angle plate, with the edge slightly overhanging to enable it to be faced, and parallel to the edge of the plate; a strap with two bolts was used to clamp it in position. By shifting the angle-plate as required, each eye in turn was centred, then drilled, bored and reamed to size.

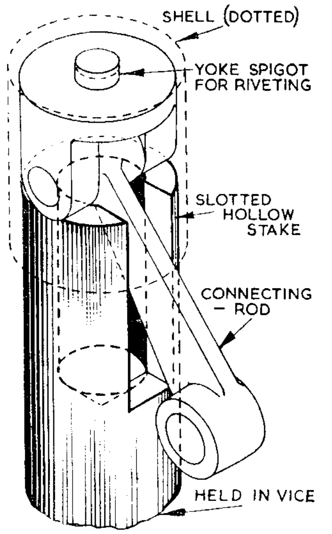
A 5/32 in. diameter stub mandrel was then made for mounting the piece to turn the big-end bosses at each end, also to face the edge back $\frac{1}{8}$ in. to the level of the little-end boss, and a further 1/32 in. to give shank clearance to the rod, stopping short of this boss. A $\frac{1}{8}$-in. mandrel was used to deal with the small-end in similar fashion. At this stage it was possible to shape the external contour of the rods, including the taper of the shank and the outside of the bosses, where they cannot be turned.

The rods were then separated by cutting down through the centre, and the mandrels again used to mount the two pieces for dealing with the other side of the bosses and shanks. Incidentally, when small rods are mounted by the eyes in this way, they are liable to slip on the mandrel when working on the sides, at a fairly large radius from the centre. To prevent this, it is a good idea to make a small clamp to fit on the jaw of the chuck, with a driving pin which can be adjusted to make contact with the rod, but without projecting so far as to foul the facing tool.

It will be seen that this method of machining produces a pair of rods which are virtually "mirror images" of each other, i.e., identical twins, which is as it should be in a twin engine.

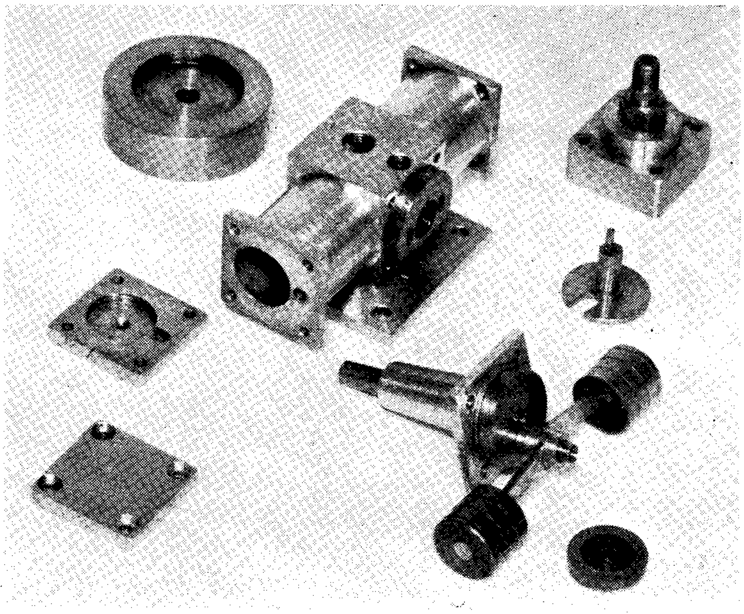
Piston Assembly

The pistons may now be fitted to the rods by inserting the gudgeon-pins through the lugs of the yokes



Piston yoke supported on a hollow stake for riveting into the shell

and the small ends of the rods, and riveting the shells to the yoke spigots. No details of the gudgeon-pins are given, as they are simply pieces of $\frac{1}{8}$-in. mild-steel rod, just long enough to go inside the piston shell; they may be made hollow by drilling $\frac{1}{16}$ in. diameter to remove a little weight, and it is also an advantage to case-harden the surface.



The components of the "Cygnet" engine

A special hollow stake will be required to hold up the yoke for riveting the spigot, as it is necessary to support the lugs firmly while avoiding any impact on the connecting-rod eye. The tool is made by drilling a piece of $\frac{7}{16}$ in. rod $\frac{1}{4}$ in. diameter down the centre, and cutting a slot in the side as shown, to enable the rod to hang clear. A half-round groove is filed across the top surface to form a seating for the lugs. Only light riveting of the spigot is required, as all the working thrust on the piston is taken on the yoke. Alternatively, if permanent fixing of the assembly is objected to, the two parts of the piston may be held together by a central countersunk screw, about 8 B.A., or better still, two 10 B.A. screws, tapped into the yoke about $\frac{1}{4}$ in. apart, but I have not used this method, as I find that screws have an annoying habit of working loose, whatever precautions to the contrary are taken; and a loose screw here could wreck the engine.

Before fixing the pistons to the rods, the latter should be tried on the crankpin, and the shaft tentatively assembled in position to make sure that the small-end eyes lie central in the liner bores. It may be found desirable to allow a little end play at the little-end between the piston lugs, to accommodate possible errors in this respect.

Valve Seating

This is turned from cast-iron, the spigot being a good fit, though not necessarily very tight, in the bore at the back of the crankcase, and all other surfaces true and concentric with it. The outer face is slightly relieved for the last 1/32 in. or so of its face radius, and recessed $\frac{5}{16}$ in. diameter in the centre for the exhaust cavity, an oblique hole being drilled from here to communicate with the vertical passage in the body.

The segmental ports in the face should be located as accurately as possible; even if one has milling equipment, it is not too easy to mill these out, and it may be found easiest to drill three holes well undersize for each port and join them up with a "mousetail" file. A useful guide in locating the ports may be produced by making the port face thicker than the finished dimension, and turning a groove in it, $\frac{1}{16}$ in. wide at $\frac{7}{16}$ in. pitch diameter, measured at the centre: the surplus metal is, of course, machined away after the ports are formed. This surface is finished by lapping on a piece of plate glass, and great care should be taken with this operation, as the flatness and smoothness of the port face has an important influence on engine efficiency. When in position, the ports should line up with the holes in the body which communicate with the passages leading to the cylinders; the recess in the steam-chest should just nip the relieved edge of the port face, so as to hold the seating in position, and form an effective steam joint at this point —not between the faces of the steam-chest and body.

Rotary Valve

This is also turned from cast-iron, and lapped on the front face; it may be machined at one setting practically all over, and finally parted off. The operations are quite straightforward, but care must be taken to get dimensions correct, except if it is desired to introduce experimental variations. It has already been mentioned that the action of the valve is comparable with that of an ordinary slide-valve; thus it will be clear that the outer edge of the face controls the amount of steam lap. Making this dimension larger would increase the lap, or smaller, would reduce it. The inner dimension of the annular face should exactly span the *inner* edge of the ports in the seating to give "line and line" exhaust, or "zero exhaust lap." It would be quite simple, if experimental settings are intended, to make two or three valves of varying dimensions and test them out.

The thickness of the valve, from front face to rear boss, should be such as to allow the minimum clearance in the valve-chest, so as to reduce the possibility of the valve sticking off its seating when starting up; the back face dimension, shown bevelled off to $\frac{3}{16}$ in., is intended to ensure that there is no risk of blanking-off or restricting the inlet to the steam chest.

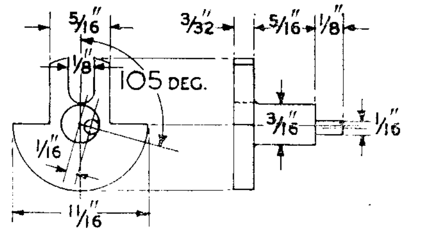
Return Crank

This is shown as made in one piece, but I have an idea that many constructors will prefer to make it in two pieces, because of the difficulty of setting out accurately the position of the tiny crankpin, which controls the angle of advance of the valve. This can be done by making the shaft with a $\frac{1}{8}$ in. diameter spigot, a tight wringing fit in the centre of the disc, and after finding the angular setting by trial, riveting or silver-soldering it finally in position.

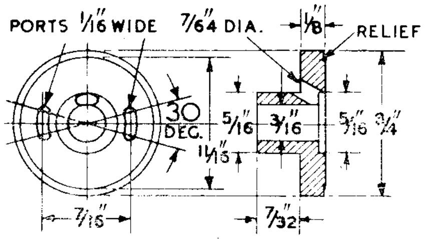
Whether made in one or two pieces, however, the crankpin may be turned on the end of the shaft by setting it over $\frac{1}{16}$ in. either in the chuck, or better still, on a vee-angle plate. The pin will just clean up to $\frac{1}{16}$ in. diameter at this setting, flush with the surface of the larger diameter, but if it does not quite do so, no harm is done so long as the pin is a good running fit in the centre hole of the rotary-valve. It will be seen that the throw of the pin controls the orbital stroke of the valve, and this again, together with the angle of advance, is subject to experimental variation; I do not claim that the settings shown could not be improved upon, but they certainly give what I consider to be very satisfactory results.

The disc is cut away to correspond with the main crank disc, and the slot should be a fairly snug fit on the end of the crankpin at the sides, but not in the bottom. When the return crank is assembled, the pin should not bottom in the centre hole of the valve, or otherwise interfere with it finding its own seating.

Although, theoretically, there is practically no variation of volume in



RETURN CRANK 1 OFF M.S.



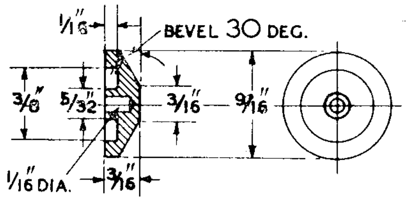
VALVE SEATING 1 OFF C.I.

the crankcase caused by piston displacement, some ventilation is necessary to allow for possible leakage past the pistons, and also expansion of air. The breather shown is adapted to screw directly into the crankcase for compactness, but it would really be better to fit an extension pipe, carrying it to a higher level. Its exact shape is not important, but side holes are desirable to deflect spray.

My old friend Ted Vanner says that this engine has something the other's haven't got—it provides a capstan for the upper deck ! But whether the position of this "capstan" would satisfy meticulous ship experts is another matter.

Owing to the thin wall of the crankcase, and the very small clearance of the working parts, only a very short thread can be provided on the breather; it is, however, desirable, in order to enable a sound thread to be cut with dies, to make it a little longer than necessary, and turn a fibre or bakelite washer to take up the surplus space. The top rim may be knurled to facilitate screwing in.

The breather also serves as the oil filler for the crankcase, but only a very little oil should be put in at a time, as any excess will be promptly pumped out again. In all enclosed steam engines, some leakage of condensate past the pistons is inevitable, and after a run there is



ROTARY VALVE 1 OFF C.I.

often more water than oil in the crankcase. Even in quite large engines, as used for dynamos and forced draught fans, where wiper glands are fitted to the crankcase, water still gets through, and the oil is soon churned up into a nauseous-looking emulsion, which in my marine engineering days was colloquially known as "turtle soup." This seems to have no ill effects on lubrication, but if left when the engines are standing, will set up corrosion, so that draining and careful internal cleaning of the crankcase is necessary; I am inclined to believe that this constitutes an argument against the use of ball-bearings in steam engines.

Assembly

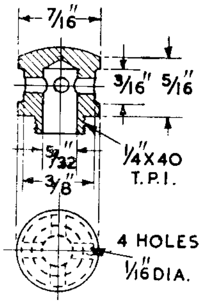
Before finally erecting the engine, one or two details remain to be attended to. The communication slots from the cylinder liners to the steam passages may be cut by clamping the body, by a bolt through the crankcase centre, to the vertical-slide or angle-plate in line with the lathe axis, and using an end-mill in the chuck. Do not forget the lubricating passage to lead oil into the main bearing.

The connecting-rods should have similar sized holes drilled from the ends of the eyes.

Make certain that the ports in the valve seating line up with those in the body, including the oblique hole into the exhaust passage. Incidentally, it is possible to vary port timing by shifting the valve seating a few degrees either way, but it should not be necessary. The exhaust passage in the body is shown in the general arrangement as tapped 5/32 in. by 40 t.p.i., but alternatively, an oval flange joint, with two 8-B.A. fixing-screws, may be used and will provide a larger passage area.

Assembly is now a very simple matter. The valve seating is first inserted, and the return crank put into its bearing from the inside. Next, the two pistons, with their connecting-rods, are inserted from the ends of the cylinders, and the big-ends lined up with the aid of a tapered rod, so that the crankpin can be put through and registered in the slot of the return crank disc. The main bearing housing is pushed over the crankcase journal and its flange secured to the body, followed by other exterior fixings such as the cylinder covers and the steam-chest. With the exception of the fibre washer on the breather, no packings of any kind are required in the joints, but it is permissible to use thin paper or tracing liner gaskets under the cylinder covers if desired.

If due accuracy in accordance with the machining instructions has been observed, and the engine turns freely without tight spots anywhere, it will be ready to go right away, as soon as either steam or air pressure is applied, and after it is run in, the absence of friction in the working parts will enable it to work on very low pressure; on the other hand, it will make the best use of high pressure if speed and power are required. Though the engine may look somewhat complicated to the beginner, it is in reality one of the very simplest of engines to build, and speaking from experience, I would much rather build an engine of this type—and be more confident of immediate success with it—than the primitive oscillating engine which is so often recommended for the beginner's first attempt. It will also be found much cleaner in its habits than the latter type, being



BREATHER
1 OFF L.A.

quite immune from throwing oil and leaking water from every joint —a point of no mean significance where it is fitted to a well-finished boat. And whatever else happens, I can at least assure constructors that they will get plenty of fun in making and using it.

Apologies to Constructors

I am sorry to have to report two errors in the detail drawings of the "Unicorn" Mill Engine, neither of which are fatal to the construction of the engine, but which might cause inconvenience to constructors. The first concerns the position of the facing for mounting the feed pump, on the side of the bedplate casting. This was intended to be shifted to enable a longer pump eccentric-rod to be used, but unfortunately the drawing of the bedplate does not show the alteration. The error has been corrected in the castings supplied by Mr. Haselgrove, but constructors making their own patterns should note that the centre of the pump seating should be 4 in. from the shaft centre-line, as shown in the pump assembly drawing.

Secondly, in the drawing of the connecting-rod, the length from the little-end centre to the foot has been marked $3\frac{3}{8}$ in. but this should be $3\frac{5}{8}$ in. Both errors will be amended in the blue prints of the engine which will be available in due course, and in making due apologies to any readers who may have been put to inconvenience, I would assure them that the sackcloth and ashes have duly been applied.

(To be continued)

THE TRIALS OF HAND TURNING

By B. Wood (East Africa)

I AM seriously thinking of putting THE MODEL ENGINEER that carried "Scotia's" fine article on hand-turning (June 14th, 1951), in a glass case and keeping it for display.

When I first read "Fun with Miniatures," the idea of actually attempting this particular type of work never occurred to me, and this copy of THE MODEL ENGINEER was filed (?) with the others in my possession.

Xmas of 1951, however, hovered in the future, with its attendant problems of Xmas presents, and, like light after a power cut, the idea dawned, that if I had the ability to make the M.L.7 behave, I had the answer.

In consequence, I marched smartly and happily into the workshop, and just as smartly, but not quite so happily, marched out again.

The first problem was to find the magazine containing directions, suggestions, etc. I set about this in a very scientific manner, but about a week later, although I did discover a great number of things which I thought I'd lost, and quite a few items which I never knew we had, I did not find what had now become the answer to my prayers. I then made the problem known to my senior partner. In a manner that will always be mysterious to a mere male, she placed the wanted article in my hands after about five minutes search. Not a little subdued by this display of feminine superiority, I once again marched (not quite so smartly) into the workshop.

A hand-rest was quickly improvised by clamping a steel bar in the tool holder on the lathe, and a graver made out of a piece of $\frac{1}{4}$ in. $\times$ $\frac{1}{4}$ in. high-speed steel.

The scrapbox produced a 14 in. length of $\frac{1}{2}$ in. diameter brass, and I started to make a bottle. Personally, I have never seen anything that looked less like a bottle, or anything else for that matter, than this first effort.

Whistling cheerfully, I parted off the first failure from it's parent brass body and started again. After I had turned about half the bar into short, weirdly-shaped pieces of brass, I stopped whistling—cheerfully or any other way—and retired with the remains of my dignity and self-esteem carefully wrapped in a matchbox.

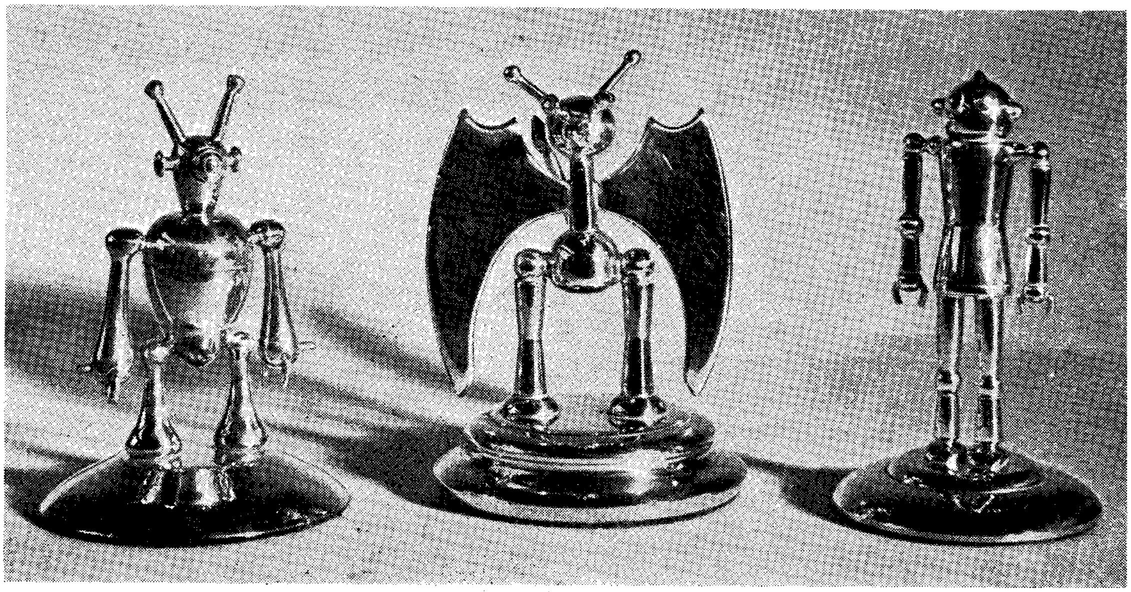
The following day I purchased a hand-rest for the Myford, and a few more pieces of high-speed steel; I made two round-nosed tools, another graver, and a "V" tool. Armed with this additional equipment, I once again attempted a bottle—no musical accompaniment!

Careful use of calipers and rule, plus a great deal of good luck, finally produced a bottle similar to the one in the photograph which supported "Scotia's" article.

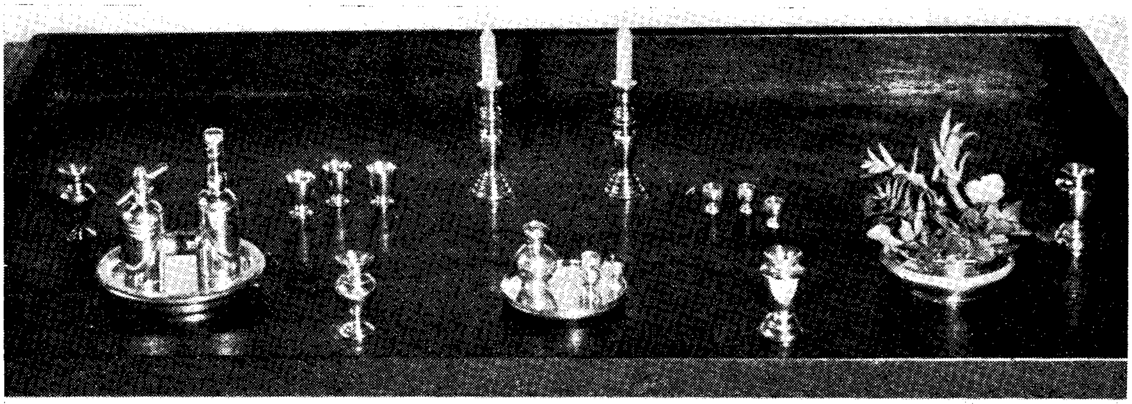
A Matching Difficulty

The glasses followed next, and the difficulty of getting the two to match was fully and bitterly experienced. This was however, finally accomplished, and the original 14 in. length of brass bar was now down to exactly 1 5/64 in., with only a very large pile of brass chips and the aforementioned short, but weird pieces, to show what had become of a length of beautiful metal.

Having a very small supply of material of the diameter called for to make the tray, I went about this last item very carefully and, much to my amazement, turned out this part of the set at the first attempt. The completed article looked very attractive; I decided that one Whisky set was an experience that



"Bert," "Bat out of Hell" and "Oscar the Robot," examples of Mr. Wood's art in hand turning



Further examples of Mr. Wood's hand turning operations

should be had by everyone with a lathe, but once bitten was enough, and I turned to more important work, leaving Xmas to look after itself. It did !

The Whisky set was duly presented to the lucky (?) person, and the genuine pleasure with which it was received almost compensated for the 14 in. bar, and experience.

A Painful Victim

A few weeks after Xmas, however, I felt a most peculiar urge to attempt some more hand turning, and realised, to my horror, that I had fallen a painful victim to the hand-turning virus. Not having anything definite in mind, I made another Whisky set, and found that I quite enjoyed it ! I learnt a valuable lesson on this second set, namely that when " Scotia " said tools must be sharp, he meant it. Having had this idea painfully elucidated for me, I really did sharpen the hand-turning tools. I also found that if the tools are really well polished with an Arkansaw stone, and kept that way, it is possible to polish a job without having to resort to any abrasive papers. Conversely, blunt tools tend to make the metal flow and form hard ridges, which it is almost impossible to remove by polishing.

Be Careful

A further source of embarrassment to the harrassed wielder of hand-tools, is the neglect to take into account the depth of the recess made in a glass, for instance. It is disconcerting, to say the least, when taking that last few thou. off the stem of the glass, to suddenly find that the top section has developed a will of its own and has deposited itself in some corner of the workshop, leaving the beheaded stem sadly spinning in the chuck jaws.

After the third Whisky set, Oscar the Robot was made. All 15 pieces were turned, and the whole lot silver-soldered at one heat. Two 10-B.A. screws hold Oscar to his base.

The first attempt at hand turning metals other than brass was made during the construction of a Stuart No. 10 engine. The top cylinder cover was " domed " with a graver, and it was found that cast-iron is comparatively easy to work in this manner. A good finish is quite easily and quickly obtained if the mandrel speed is correct.

Accuracy

The turning of small diameter steel rods is also made much easier, and accuracy to within a thou. is not difficult to obtain. Here again, good finish is dependent on mandrel speeds and sharpness of the tools used.

Having made this last momentous discovery, I was slightly deflated to learn that horological workers were aware of it all the time. (The last is not a pun, intentionally or otherwise.)

" Bat out of Hell " started as a candlestick. Having completed the Bat's badly battered body, (considered as a candlestick) serious consideration and much thought convinced me that, no matter from which angle the brightly polished brass was viewed, it simply did not look at all like a candlestick. Being faced with the alternative of either hurling the failure out of the window, this time making sure the window was open, or turning it into something else, I chose the latter course.

I envisioned a graceful bird, but settled for the " Bat "! Several people seem to be under the impression that the Bat's body should have been hurled out of the window in the first place (open or closed) and forgotten.

Having completed the tedious job of polishing this last paper-weight after silver-soldering, I started work on a Cowell $\frac{3}{8}$-in. drilling machine.

Demonstrating the ease of hand turning to a neighbour's friend, a vase " happened." Several pairs followed.

Gruesome " Bert "

" Bert," the third of the gruesome threesome, started on the back of a cigarette box, and is the only hand turned job I have done to a drawing (?) sketch (?) work of art (?)—excluding the Whisky sets.

Inspired by Bert's " beauty " (?) —and the remarks of one or two people—plus a short length of $1\frac{1}{4}$ in. diameter brass, I decided to try a rockery bowl.

For some reason, not at all clear to me, people, while quite complimentary on the subject of the rockery bowl, fail to suppress a shudder, and a suspicious gleam in their eye when they meet " Bert."

This last reaction has made me slightly dubious about even mentioning the word " design," let alone discussing it; so I conclude on a word of advice to the embryo hand tool wielder. Read, enjoy and take careful note of " Scotia's " article, before attempting the hand rest battle; it will be worth it.

The photographs illustrating this article were taken by J. S. Karmali.

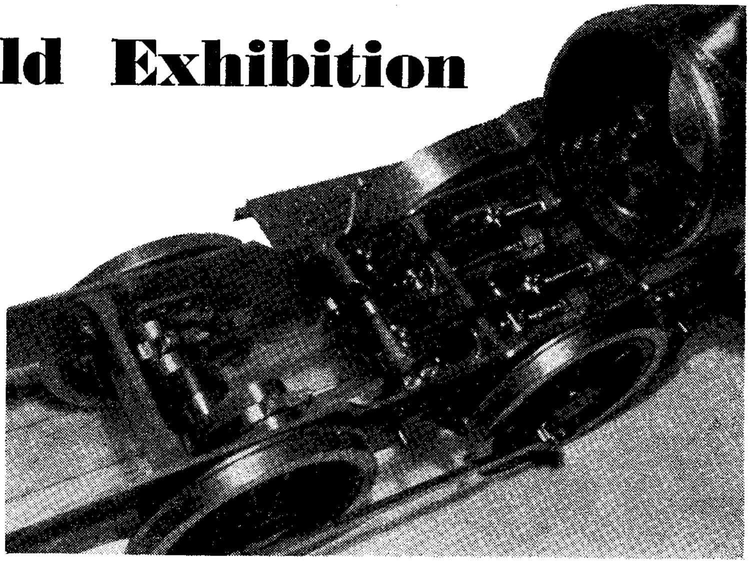
Huddersfield Exhibition

Reported by

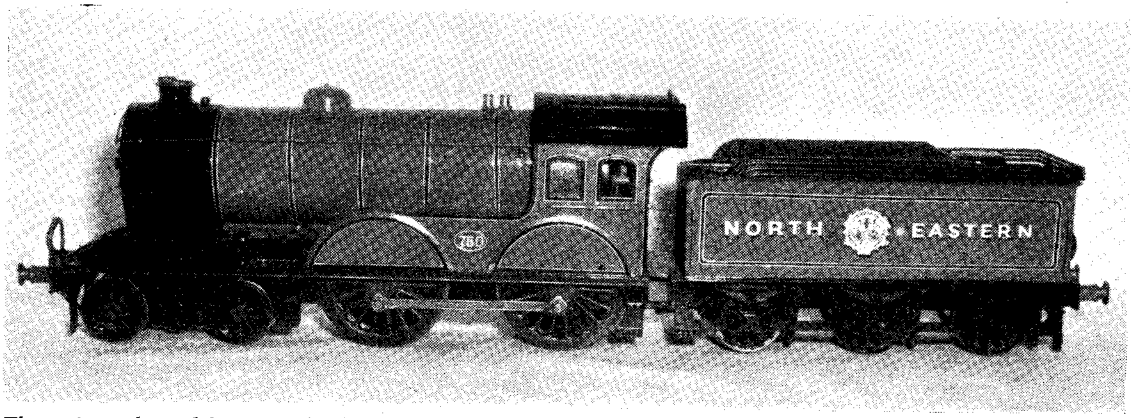
" Northerner "

WE have already remarked on the beautiful tank engine built by L. R. Raper, which won a Championship Cup two or three years ago. (Incidentally the tool-kit for this engine—hammer, pliers, " footprints," Stillson wrench, and so on, all to $\frac{3}{4}$-in. scale—is an exhibition-piece on its own !) Now Mr. Raper is building a 5-in. gauge " Aspinall " 0-6-0 goods which is

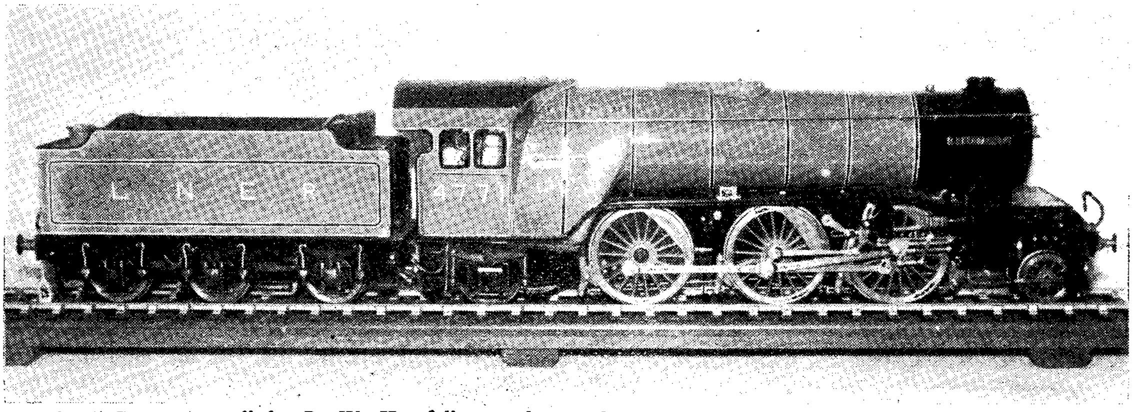
Continued from page 646, *November* 26, 1953.



Cylinders and motion, including Joy valve-gear, of L. R. Raper's 5-in. gauge " Aspinall " 0-6-0 *locomotive*



The paintwork and lining, with the beautifully executed coat-of-arms, added greatly to the attraction of Frank Cook's " No. 750."



This " Green Arrow " by D. W. Horsfall was also nicely painted, and the mechanical finish was good, too

in every way as good as, if not better than, the tank.

The finish is superlative, and the detail is very complete—for example, the big-end nuts are of the castle type, with split-pins, and the valve- and piston-rod forks are cottered to the rods. There's a long way to go yet, but what an engine this is going to be !

Among the completed locomotives, my eye was taken by the N.E.R. 4-4-0 by F. Cook of Leeds. The finish on the brightwork was good, and the painting and lining, too—the coat of arms on the tender added an excellent touch of brightness and authenticity.

A fine exhibit, also, was the *Green Arrow* built by D. W. Horsfall of Brighouse. Here again the finish was very good in the machining and the " hand-work ": painting and lining were nicely done, though the lettering and figures could be better.

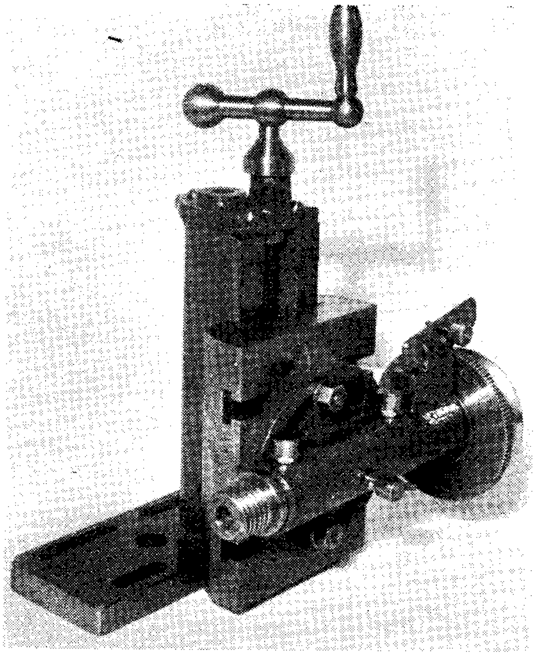
Other Exhibits

There were several good entries among the workshop equipment, typical of which was the vertical-slide with milling and dividing spindle built by J. Clegg of Rochdale.

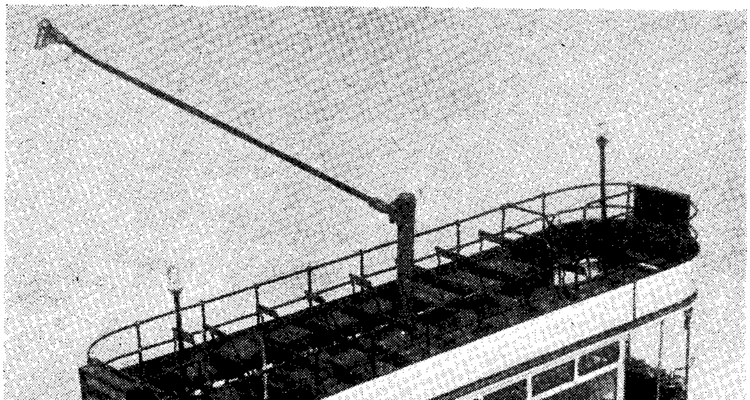
This had a substantial casting for a foundation, and the slides were hand-scraped. There was a micrometer collar on the feed-screw, and the swivelling base of the milling spindle was divided into degrees.

The nose of the spindle was screwed to fit chucks, and the vee-pulley for the drive was notched on its edge; a blade drops into one or other of the notches to effect the dividing.

Tramcars have a fascination for many people, and one could understand this on seeing the $\frac{3}{8}$-in. scale model built by E. Thornton of Bradford. It was of an open-top vehicle as used by Bradford City Tramways in 1903, and the detail work was very good indeed; even the chassis was sprung. As for the lining and lettering, these were really excellent, adding greatly to the appearance of the model. Would that the same could be said of every model one sees !



A robust vertical-slide with milling and dividing spindle built by J. Clegg of Rochdale,



E. Thornton of Bradford specialises in tramways; here is his $\frac{3}{8}$-in. scale model of an open-top car of 1903

Can a full-sized traction-engine be considered an exhibit at a models exhibition ? Whether it can or not, it is a fact that Dan Hollings' Foden compound caused great interest as she stood outside the hall, ticking over gently. She is in very good condition, and Dan is to be congratulated on securing a rather uncommon engine, in such good shape. But quite a change from small locomotives !

" TITFIELD THUNDERBOLT "
Cylinder-block Castings

W. K. Waugh, of Bearsden, has sent us a sample of the casting he is producing for *Titfield Thunderbolt's* cylinder-block. It is a clean casting in good-quality bronze, and has the ports cast deeply in the top face. Holes for the cylinder bores are included, and the whole unit has obviously been thought out so as to aid the machining of it as far as possible.

READERS' LETTERS

● Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

A NOVEL CROWN

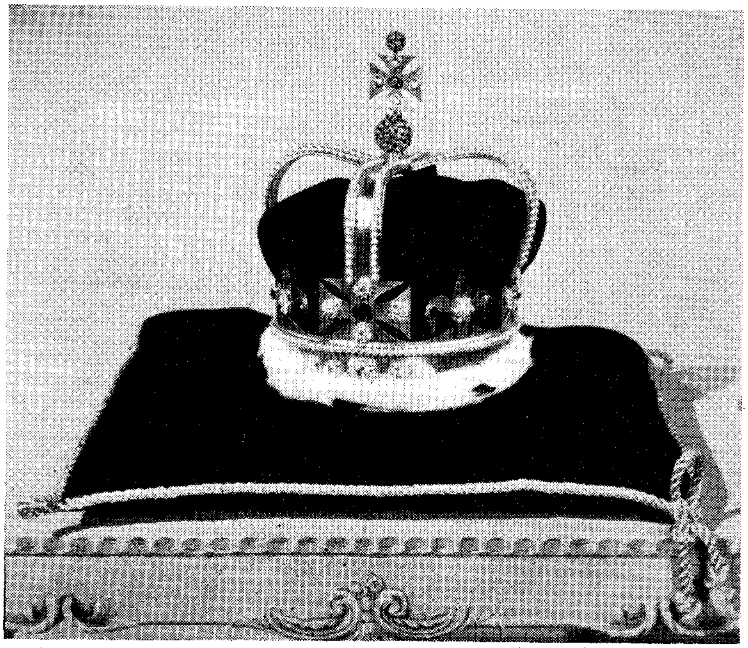
DEAR SIR,—Some weeks ago, the chairman of the local Chamber of Trade approached me (having heard I dabbled a bit in metals) and asked if I thought I could make a crown for this year's local Carnival Queen. The photograph shows the result of the effort to do so.

The body of the crown was cut from 24-gauge brass plate, the arched pieces being attached with "Easyflo." Parallel strips of $\frac{1}{8}$ in. half-round brass were soldered along each edge of the "arches" and also round the top edge of the main frame; these formed a bed for the strings of pearls, which were attached with Durofix. The contour of the main frame was cut with a Tyler blade and the jewels were Woolworth earrings, with the mounts removed and then fixed in position with Durofix. The large orb carrying the top Maltese cross was an old dress ornament, the top one the end of a hat-pin. Both were made up of brilliants. The other stones and brilliants were let into holes drilled in the plate and bedded in Durofix. After making, the whole of the metal was covered with gold-size and when this was tacky, "gold" powder was dusted on and gave the whole a quite authentic appearance. The lady of the house completed the job!

I have now returned again to making my version of *Britannia*, and feel much more at home. I send my thanks and best wishes to "L.B.S.C."

Yours faithfully,

Ashford, Kent. J. HANSON.



ELECTRONIC ORGANS

DEAR SIR,—I would like to make it known that I, the maker of the organ, some progress on which was described in these pages in December, 1935, am not the contributor of the same name referred to in recent correspondence on electronic organs.

Yours faithfully,

Snaresbrook. C. H. CLARKE.

THIS JUDGING BUSINESS!

DEAR SIR,—In view of the comments which have been made regarding the judging of exhibition models, perhaps a few words from the judge's point of view may not be out of place.

The task of judging entries in a model exhibition is no sinecure; the judges are invariably under fire from several quarters, and there are some individuals—not, as a general rule, the competitors themselves—who seem to regard it as a matter of principle to declare that the judges are always wrong. Honest and constructive criticism is by no means to be discouraged, and is welcomed by the judges themselves, who being human, are not infallible. But criticism is often ill-informed, and there is much confusion of thought as to the methods whereby the judges arrive at their decisions.

It may be said at the outset that competition judges are very carefully chosen, and that quite apart from their technical qualifications, which include both academic knowledge and practical experience of models in their particular field, have also to be good team workers and capable of subduing their own personal likes and dislikes. They must, above all, beware of the easy path of snap decisions; so often it happens that a model which appears an easy winner will, on close inspection, be found to contain serious errors, while a much less impressive model will reveal inconspicuous but no less solid virtues.

In the judging of entries in the "M.E." Exhibition, a system of marking is adopted in which all factors are taken into account, so far as possible, by awarding points under a number of different headings, such as workmanship, fidelity to prototype, originality of design, etc. The total number of marks awarded may thus be regarded as a very fair assessment of the merit of the particular entry.

If an exhibit is entered as a working model, the judges, while tentatively accepting the statement that it is capable of working, have sufficient knowledge to assess its merits in that particular capacity, without undertaking the task of

putting it to a practical working test which, if one takes into consideration the number and variety of models to be judged, would clearly be impossible in the time available. The constructor of a "prototype" model, or one which has deficiencies from the aspect of working, *might* possibly fake it up to look good, but it is hardly conceivable that it would deceive the keen eyes of experienced judges. By careful scrutiny of the *craftsmanship* in a model, it is possible to obtain a very shrewd idea of its working efficiency; and this is borne out by the fact that working models which have been highly placed in the "M.E." Exhibition have nearly always been found to work efficiently when subsequently put into service.

It should be noted that non-working models are judged on a very different basis to working models, far more emphasis being placed on realism and fidelity of detail, and, therefore, the idea that a poor working model with elaborate superficial external show would be placed higher than a sound working model, simply does not arise. In the case of a non-working model, such as a period ship model, for instance, the most meticulous accuracy in detail work is demanded, whereas in a working ship model, the merits of its power plant and other interior fittings, not to mention its general design in relation to its intended function, are all capable of winning points, so that more latitude is allowable in respect of exterior details. Needless to say, a *working* model in which both interior and exterior details were beyond reproach would necessarily have a great advantage over a non-working model with no interior detail; but in practice such instances are rarely, if ever, encountered.

In the case of a model made to a published design, it is possible for it to attain high marks for fidelity *to the design*, by following the drawings and description carefully; but many constructors of such models have gone further, by adding detail or minor improvements to the design, thereby gaining points not only for fidelity, but also for design and originality. In short, it may be said that the judges adhere closely to the principles which the exhibition is primarily intended to promote; namely, good craftsmanship, accuracy and progressive design of models; and so far as is humanly possible, their decisions are arrived at without bias or favour.

Yours faithfully,
ONE OF THE JUDGES.

MODEL CARS

DEAR SIR,—The recent comments on the model car movement tempt me to add my views and experience on the matter. Being interested in building i.c. engines for more years than I care to think about, the model car movement, after the war, gave me the opportunity to try out my efforts, and believe me, I am still trying them out. It is very interesting to pit your own work against the commercial jobs. I have heard unfavourable remarks once or twice from "experts," but these people just fade out as we go along. It was obvious from the start that racing would predominate, but there is no end of scope for the model engineer who wants to build and race his own car. The scale model fan is well catered for by the M.C.A. with the Austin, and Russell Trophies. In the Sutton and Percival Marshall Memorial, speed is also of no account. It is obvious that everyone who wants to take part in the model car movement cannot have the skill and the know-how, so, therefore, he must buy his stuff, and he wants the best he can afford. Plenty of owners of American engines and cars have confessed to me that they would rather build their own, and would be quite satisfied if they ran at all. I might mention, from my own experience, that when a home-built car is successful at an open meeting, the applause received is well worth the time you have spent on the car. I have found many friends at open meetings, and thoroughly enjoy a day out as a relaxation from the humdrum of everyday life.

Yours faithfully,
Leeds, 6. H. PICKERSGILL,
Hon. Sec. Guiseley M.E. Club

MAKING MORSE TAPER ARBORS

(*Continued from page* 664)

fit accurately in the base of the drill chuck by making any necessary corrections of the topslide setting with the aid of the test indicator.

Securing the Chuck on its Arbor

Some workers secure the chuck to its tapered arbor with a screw passing through the base of the chuck; in this way, if the drill digs into the work, there is no danger of the chuck being drawn off its arbor. To fit the screw, the arbor, while still mounted in the lathe mandrel, is drilled axially and tapped 4 B.A. The base of the chuck is then drilled No. 24 and tapped 2 B.A. This enables the chuck to be readily removed from its arbor by inserting a No. 2 B.A. screw into the chuck body from within. The chuck base can be easily drilled by gripping a short length of rod in the jaws, and then gripping the projecting end of the rod in the lathe chuck; the drilling is then carried out from the tailstock.

Arbors for Mounting Milling Cutters

These arbors are made in the same way as in the previous example; but, instead of machining the second taper, a parallel seating is turned for mounting the cutter and the end of the arbor is threaded to take a clamp-nut.

Some milling cutters have threaded bores; in this case, the corresponding thread on the arbor is best formed by screwcutting.

End-mills with parallel shanks can be mounted in these mandrel arbors by finishing the bore to the exact size with a small boring tool, and then securing the cutter in place with a set-screw.

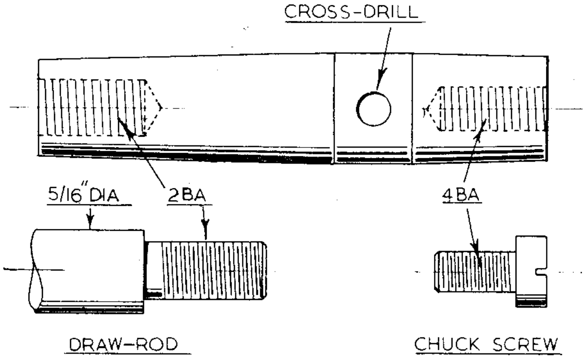


Fig. 5. A drill chuck arbor tapped for a draw-rod and a securing-screw